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ABSTRACT

A detailed study was conducted to analyze the role of national defense in shaping employment demand by occupation, both nationally and regionally, over the next 5 years. Data were gathered through the Regional Occupation Planning and Evaluation System (ROPES) in which detailed information on the employment of 163 occupations in 82 industries and information on the distribution of expenditures for defense among supplying industries were combined within a system of economic forecasting models to estimate future employment by occupation nationally, by state, and for each of 70 major cities. Some of the conclusions reached by the study were the following: (1) between 1981 and 1987, the total employed labor force will increase by more than 7 million jobs; (2) one of every five new jobs will be required to supply goods and services to support increasing expenditures for defense; (3) in nearly all industries, defense-related employment will account for over 10 percent of net new jobs; (4) in some industries, total new defense-related employment will be greater than total net new jobs; (5) shortages in trained workers may occur for computer personnel, engineers, technicians, electronic wirers, aircraft mechanics and assemblers, pipefitters, machine tool operators, machine tool setters, punch press setters, and other metalworking operatives; (6) the impact of defense expenditures will continue to be concentrated in California, Texas, New York, Pennsylvania, Florida, Ohio, Virginia, Illinois, Massachusetts, New Jersey, Indiana, and Connecticut; and (7) there may be a critical shortage of workers in 28 skilled categories in 24 major metropolitan areas. (No attempt was made in this study to forecast employment supply. Details of the forecast are contained in volume 2 of this study.) (KC)

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REGIONAL FORECASTS OF INDUSTRIAL BASE MANPOWER DEMAND, 1981 TO 1987

Volume I: Forecast Summary

Prepared by

Ralph M. Doggett
Data Resources, Inc.

Prepared for

The Office of the Undersecretary of Defense
for Research and Engineering
Department of Defense
Washington, D.C.

March 1983

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Regional Forecasts of Industrial Base Manpower Demand, 1981 to 1987

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EXECUTIVE SUMMARY

Between 1981 and 1987, the total employed labor force will increase by over 7 million jobs. One out of every 5 new jobs will be required to supply goods and services to support increasing expenditures for defense. These are summary conclusions of a detailed study analyzing the role of defense in shaping employment demand by occupation, both nationally and regionally, over the next 5 years. The following is a summary of other conclusions from the study.

- o Expenditures for defense will take on an increasingly important role in shaping the major dimensions of the nation's economy. As a percent of Gross National Product defense expenditures have fallen steadily from nearly 10 percent in 1968 to 4.3 percent in 1980. By 1987 the defense share of GNP will approach 7 percent.

- o Changing patterns of defense expenditures will accentuate their impact on American industry and the nation's labor force. Increasing shares of the defense budget are slated for procurement items. The military personnel share of defense expenditures will decline. Consequently, the fraction of each defense dollar received directly and indirectly by the private sector will grow, and the defense share of private sector employment will also grow.

- o In nearly all industries, defense-related employment will account for over 10 percent of net new jobs. In some industries, total new defense-related employment will be greater than total net new jobs. These include producers of ferrous and nonferrous metals, the aerospace industries, several electronic equipment manufacturers and producers of scientific instruments.

- o Growth in production by major defense supply industries and their suppliers as well will be substantially greater than growth experienced throughout the 1970's. Restoration of unutilized capacity and/or capacity additions will be required so that these industries will be capable of meeting defense needs.

- Nationally, the demand for workers skilled in the use, operation and repair of computer equipment will grow at especially rapid rates throughout the 1980's. Between 1981 and 1987 an estimated 240 thousand jobs will become available for persons with these skills, representing a 34 percent increase over 1981 employment levels. These skills will be particularly affected by increased expenditures for defense. Other occupations for which potential national shortages are in the offing include electrical engineers, aeroastronautic engineers, mechanical engineers, metallurgical engineers, economists, electrical and electronic technicians, electronic wirers, aircraft mechanics, aircraft assemblers, pipefitters, machine tool operators, machine tool setters, punch press setters and other metalworking operatives.

- The impact of defense expenditures will continue to be concentrated in the following states: California, Texas, New York, Pennsylvania, Florida, Ohio, Virginia, Illinois, Massachusetts, New Jersey, Indiana and Connecticut. Industries in these 12 states supply nearly 60 percent of the goods and services required directly and indirectly to satisfy defense needs. In 1981 defense purchases accounted for 7 percent or more of total production in 10 states. By 1987 expenditures for defense will account for 7 percent or more of total production in 26 states. Especially sharp increases in the defense share of total production will be seen in Connecticut, Virginia, Alabama, Washington, and California.

- California will provide 22 percent of total net new jobs between 1981 and 1987. Texas will provide 12 percent, and Florida will provide 9. These 3 states plus Massachusetts, New Jersey and Virginia will supply over half of the total. Defense-related employment in these 6 states plus New York will account for over 10 percent of net new jobs nationally.

- Out of 163 occupation categories comprising the entire civilian workforce, employment growth in 28 skilled categories, particularly defense-related employment growth, will be rapid enough to promote concern in 1 or more of 24 major metropolitan areas across the nation. The following is a capsule summary of potential problem areas, by metropolitan area and occupation. The criteria for selection were: 1) Net new employment of the

occupation nationally will exceed 1000 new jobs between 1981 and 1987; 2) The rate of growth in the employment of the occupation in the region is at least double the rate of growth of all occupations nationally; and 3) the rate of growth in defense-related employment of the occupation in the region is at least double that of total employment growth of the occupation in the region.

Anaheim

- Electrical and Electronic Technicians
- Professional and Technical Workers, NEC
- Construction Crafts Workers, NEC
- Blue Collar Worker Supervisors
- Inspectors
- Electrical and Electronic Assemblers
- Assemblers, NEC

Atlanta

- Construction Crafts Workers, NEC

Binghamton

- Assemblers, NEC

Boston

- Electrical Engineers
- Electrical and Electronic Technicians
- Electrical and Electronic Assemblers
- Assemblers, NEC

Bridgeport

- Inspectors
- Assemblers

Dallas-Ft. Worth

- Mechanical Engineers
- All Other Engineers

Dallas-Ft. Worth (continued)

- Electrical and Electronic Technicians
- Professional and Technical Workers, NEC
- Construction Crafts Workers, NEC
- Blue Collar Worker Supervisors
- Inspectors
- Electrical and Electronic Assemblers
- Assemblers, NEC

Denver

- Professional and Technical Workers, NEC
- Construction Crafts Workers, NEC
- Assemblers, NEC
- Operatives, NEC

Hartford

- All Other Engineers
- Aircraft Mechanics
- Inspectors
- Aircraft Structure and Surface Assemb.
- Assemblers, NEC

Houston

- Professional and Technical Workers, NEC
- Construction Crafts Workers, NEC

Los Angeles

- Industrial Engineers
- All Other Engineers
- Drafters
- Electrical and Electronic Technicians
- Engineering and Science Technicians, NEC
- Professional and Technical Workers, NEC
- Electricians
- Plumbers and Pipefitters
- Construction Crafts Workers, NEC
- Aircraft Mechanics

Los Angeles (continued)

- Auto Mechanics and Repairers
- Maintenance Mechanics and Repairers-General Utility
- Machinists
- Sheet-Metal Workers and Tinsmiths
- Blue Collar Worker Supervisors
- Inspectors
- Testers
- Aircraft Structure and Surface Assemblers
- Electrical and Electronic Assemblers
- Assemblers, NEC
- Drill Press and Boring Machine Operators
- Grinding and Abrading Machine Operators
- Lathe Machine Operators, Metal
- Machine Tool Operators, Combination
- Milking and Planning Machine Operators
- Welders and Flamecutters
- Filers, Grinders, Buffers and Chippers

Nassau-Suffolk

- Electrical Engineers

New York

- Electrical Engineers

Orlando

- Professional and Technical Workers, NEC
- Operatives, NEC

Phoenix

- Electrical Engineers
- Professional and Technical Workers, NEC
- Electrical and Electronic Assemblers
- Assemblers, NEC
- Operatives, NEC

San Diego

- Professional and Technical Workers, NEC
- Construction Crafts Workers, NEC
- Assemblers, NEC

San Jose

- Electrical Engineers
- Electrical and Electronic Technicians
- Professional and Technical Workers, NEC
- Blue Collar Worker Supervisors
- Inspectors
- Electrical and Electronic Assemblers
- Assemblers, NEC
- Operatives, NEC

Seattle

- Aero-astronautic Engineers
- Construction Crafts Workers, NEC

Wichita

- Professional and Technical Workers, NEC

SECTION 1: INTRODUCTION AND OVERVIEW

There has been increasing concern as to whether there will be adequate supplies of skilled manpower to satisfy future demands on the nation's industrial base. Of particular concern is the impact that increased expenditures for defense may have on the demand for skills critical to supplying defense needs. This concern is underscored by the absence of information on the magnitudes of future demands, the locations of these demands by state and major metropolitan areas, and the role of expenditures for defense in shaping demands for labor by occupational skill. In 1982 Congress directed the DoD to prepare an analysis of the expected level of demand for skilled labor in the civilian workforce, by type skill and by regions of the country to accomplish defense programs during fiscal years 1983 through 1987.

This report presents the findings of that analysis in which detailed information on the employment of 163 occupations in 82 industries and data on the distribution of expenditures for defense among supplying industries were combined within a system of economic forecasting models to estimate future employment by occupation nationally, by state, and for each of 70 major cities. This system, called the Regional Occupation Planning and Evaluation System (ROPES), provides forecasts to 1987 of total employment by occupation within each of the states and cities, as well as estimates of the numbers of persons employed within each occupation that are required to satisfy defense needs, directly and indirectly. One of the models used in this study is the DRI Defense Interindustry Forecasting System (DIFS), which is very similar to Defense Economic Impact Model (DEIMS) used by DoD. The differences between the two models does not have substantial implications for the results presented here.

The system was developed in order to respond to the ongoing need for manpower planning data at the regional and local levels. In recent years, state and local government agencies, manufacturers and educators have sought to increase the quality of manpower planning through a variety of forecasting techniques. The development of ROPES represents the first effort by the Department of defense to disaggregate the manpower impact of expenditures for Defense to the location of performance in order to assist manpower planning organizations in identifying local

trends in labor demand. It should be noted, however, that competitive relationships are subject to change in the future, and may have some effect on demand forecast projections.

The forecasts presented in this report reflect trends in labor demand. By identifying separately the employment by occupation required to satisfy defense needs, the impacts of future expenditures for defense can be assessed with respect to growth in total employment by occupation. For example, it may be concluded that for those occupations in which employment for defense is projected to grow at rates comparable to or lower than rates of growth in total employment, that supply shortages are unlikely. However, if the regional defense requirement for a particular occupation is projected to increase at a rate significantly greater than that of total employment of the occupation in the region, it may be concluded that there is a potential for local shortages, absent an increase in supply. Similarly, if employment for defense and total employment are projected to increase at rates substantially greater than rates experienced historically, critical shortages may be imminent.

The analyses presented in this report do not address labor supply considerations. With the rare exception of a few highly structured occupations (e.g., medical doctors), the state of the art in supply forecasting is inadequate for drawing definitive conclusions with regard to impending supply/demand imbalances. However, local manpower planning organizations may well have developed accurate estimates of current supply for some occupations, and it is hoped that the demand trends indicated by ROPES forecasts will be useful for comparative purposes. Further, it should be noted that although it would be desireable to evaluate the impact of mobilization on the current manpower forecasts, adding such broad assumptions to regionalized data would so substantially increase the level of uncertainty as to render the forecast results dubious at best.

It may be noted at this point that ROPES estimates of employment by occupation in 4 states - New York, Connecticut, Massachusetts, and California - have been reviewed by representatives of the state government employment planning agencies of each. These representatives have indicated that by and large the ROPES estimates for 1981 are consistent with their own independent estimates. Further cooperation between the state governments and Department of Defense will ensure

that descrepancies can be corrected and that accuracy can be enhanced. Moreover, the inclusion of explicit estimates of the role of defense in shaping trends in employment by occupation at the state and local level will provide valuable input into the regional manpower planning process.

The next section presents a summary forecast of economic conditions and their implications for employment by occupation both nationally and regionally. Section III provides a description of the methodology and data sources used in ROPES. An appendix provides detailed forecasts for selected states and metropolitan areas. Complete forecasts for the nation, all states and 70 cities are contained in a second volume to this report.

SECTION II: FORECAST SUMMARY

A. The Macroeconomic Environment

Trends in employment by occupation at the state and substate levels are ultimately affected by national economic conditions, which in turn are affected by federal fiscal and monetary policies, relationships with trading partners, prevailing interest rates, inflation, and other factors. The forecasts and conclusions presented in this report are based on some underlying assumptions with regard to these factors, which have been embodied in a macroeconomic forecast of the U.S. economy.

This forecast, which was developed in November, 1982, has a horizon of 1987. Summary statistics associated with the forecast are presented in Table II.1. As can be seen, total economic activity as measured by Gross National Product, is projected to grow at a modest rate of 2.9 percent per year between 1981 and 1987, from $2.9 trillion (in constant 1981 dollars*) to $3.5 trillion. The constrained growth over the interval shown reflects the recessionary conditions of 1982, from which recovery is seen in 1983.

The recovery is spurred in part by rapid growth in consumer purchases of durable goods, particularly motor vehicles, and in increased investment activity. The latter is most rapid in the purchases of new structures, as the housing market rebounds from its recent depression. Net exports (exports minus imports) are projected to decline steadily from $26 billion in 1981 to -$19 billion in 1987, in constant 1981 dollars, but increase in current dollar terms, reflecting more rapid growth in the cost of imported goods.

Federal government purchases of goods and services are assumed to grow in the forecast at the rapid rate of nearly 5 percent per year, due to emphasis on purchases for defense and despite real declines in nondefense federal expenditures through 1985. These estimates reflect provisions of the FY83 budget requests submitted to Congress in February, 1982 and amended in the summer of that year.

*Unless otherwise indicated, all dollar values discussed in this report are expressed in terms of constant 1981 prices.

TABLE II.1: SUMMARY FORECAST OF THE U. S. ECONOMY
(BILLIONS OF 1981 DOLLARS EXCEPT AS NOTED)

	1981	1982	1983	1984	1985	1986	1987	AVG. ANN. %GROWTH 81 TO 87
COMPOSITION OF GROSS NATIONAL PRODUCT								
GROSS NATIONAL PRODUCT	2,937.7	2,896.1	2,995.8	3,130.4	3,259.3	3,388.0	3,497.4	2.9
PERSONAL CONSUMPTION EXPENDITURES	1,843.1	1,862.4	1,923.7	1,996.4	2,060.4	2,134.8	2,200.8	3.0
DURABLE GOODS	234.5	232.3	253.2	278.4	294.2	312.2	324.7	5.6
NONDURABLE GOODS	734.5	741.1	760.8	776.8	792.4	809.1	825.2	2.0
SERVICES	874.1	889.8	908.0	936.5	967.5	1,005.2	1,041.6	3.0
GROSS PRIVATE DOMESTIC INVESTMENT	471.5	419.2	452.1	507.9	550.9	583.5	607.1	4.3
FIXED INVESTMENT	451.1	427.4	437.7	478.4	516.5	547.4	571.9	4.0
STRUCTURES	231.5	224.5	236.5	257.6	279.0	294.9	304.8	4.7
EQUIPMENT	219.6	204.2	204.3	224.0	241.1	256.1	270.0	3.5
CHANGE IN INVENTORIES	20.5	-8.1	14.4	29.5	34.5	36.2	35.2	9.5
EXPORTS	367.4	352.7	361.4	383.9	404.2	422.9	440.6	3.1
IMPORTS	341.3	343.4	360.0	386.1	408.9	434.0	459.7	5.1
GOVERNMENT PURCHASES	597.0	598.8	610.8	618.9	642.6	668.6	693.2	2.5
FEDERAL GOVERNMENT	228.9	235.2	250.2	260.7	277.8	293.4	304.3	4.9
DEFENSE	153.7	153.7	181.5	197.1	215.1	230.4	241.0	7.8
NONDEFENSE	75.2	71.5	68.9	64.0	63.4	63.8	64.2	-2.6
STATE AND LOCAL GOVERNMENT	368.0	363.5	360.4	358.0	364.5	374.9	388.6	0.9
OTHER KEY MEASURES								
IMPLICIT PRICE DEFLATOR (%CHANGE)	9.4	6.3	5.9	6.0	6.7	6.8	6.8	6.4
CONSUMER PRICE INDEX (%CHANGE)	10.3	6.3	5.8	6.1	6.6	6.9	6.9	6.4
UNEMPLOYMENT RATE (%)	7.6	9.5	9.1	8.2	7.5	6.9	6.6	-2.4

Other key elements of the macroeconomic environment used in this study include a much more tame rate of inflation than that which was seen in the last several years. The implicit price deflator for Gross National Product is projected to decline from its annual rate of 9.6 percent in 1981 to a low of 5.9 percent in 1983, before increaseing to 6.8 percent by 1987. A similar pattern is forecast for the consumer price index, which grows at annual rates below 7 percent from 1982 forward. The unemployment rate measures 9.5 percent in 1982, the highest since before World War II, but declines sharply in the forecast to a low of 6.6 percent in 1987.

The levels of expenditures for defense assumed in the forecast are a key determinate of employment growth and the mix of occupations within the nation's workforce of the future. Of particular significance is the shifting pattern of expenditures for defense by category of expenditure. As can be seen in Table II.2, total expenditures for defense are projected to increase at a real average annual growth rate of 7.8 percent between 1981 and 1987. Most of this growth will be in expenditures for procurement. Consequently, the distribution of expenditures for defense is changing dramatically, and this change can significantly affect the directions and magnitudes of the impacts of defense purchases on employment. In 1981, over 30 percent of total defense outlays were for the compensation of active and retired military personnel. By 1987 this share is projected to decline to 22 percent of total expenditures. Conversely, 24 percent of the 1981 budget was spent on procurement, and this share is projected to rise to over 33 percent by 1987. Consequently, over half of the total growth in defense expenditures will be for procurement items supplied by the private sector and employing the nation's workforce.

B. Employment Growth by Industry

The macroeconomic environment described above implies a successful recovery from the 1982 recession and the return to work for millions of unemployed construction, production, and service workers. Table II.3 presents the forecast of total private, nonagricultural employment in each of 72 industries. Seven industries will experience employment growth at rates greater than 2 percent per year, which is nearly double the national average. These industries include the largest suppliers of goods and services for defense, particularly Ordnance and Accessories (with growth at 5.8

TABLE II.2: DISTRIBUTION OF EXPENDITURES FOR DEFENSE
BY MAJOR BUDGET CATEGORY

CATEGORY	1981	1982	1983	1984	1985	1986	1987	AVG. ANN. % GROWTH 81 TO 87
	BILLIONS OF 1981 DOLLARS							
MILITARY PERSONNEL	36.4	35.3	37.4	38.2	39.4	40.1	40.5	1.8
RETIRED PAY	11.9	11.2	11.8	12.0	12.4	12.7	13.0	1.5
OPERATIONS & MAINTENANCE	49.2	57.8	59.5	62.2	66.6	70.8	73.6	7.0
PROCUREMENT	36.5	38.6	48.5	57.9	67.1	75.2	80.6	14.1
AIRCRAFT	13.9	14.9	19.1	22.9	27.2	30.6	32.1	14.9
MISSILES	6.1	6.4	8.1	9.9	11.6	12.9	13.7	14.6
WEAPONS & TRACKED VEHICLES	2.0	2.4	3.0	3.5	3.8	4.1	4.2	13.1
SHIPS & CONVERSIONS	5.1	4.8	5.6	6.7	6.9	7.5	8.3	8.6
AMMUNITION	1.4	1.4	1.7	2.0	2.3	2.7	3.1	14.4
OTHER	8.0	8.6	10.9	13.0	15.2	17.4	19.3	15.7
RESEARCH & DEVELOPMENT	15.8	16.5	19.1	20.9	22.8	23.9	24.9	7.9
MILITARY CONSTRUCTION	3.9	4.3	5.2	5.9	6.9	7.7	8.3	13.3
TOTAL	153.7	163.7	181.5	197.1	215.1	230.4	241.0	7.8
	PERCENT DISTRIBUTION							
MILITARY PERSONNEL	23.67	21.58	20.63	19.37	18.30	17.41	16.82	-5.53
RETIRED PAY	7.77	6.83	6.48	6.10	5.76	5.52	5.41	-5.87
OPERATIONS & MAINTENANCE	31.99	35.34	32.81	31.54	30.97	30.72	30.55	-0.77
PROCUREMENT	23.73	23.57	26.73	29.39	31.20	32.64	33.46	5.89
AIRCRAFT	9.05	9.10	10.51	11.62	12.67	13.28	13.31	6.64
MISSILES	3.94	3.94	4.47	5.02	5.39	5.61	5.68	6.30
WEAPONS & TRACKED VEHICLES	1.31	1.45	1.68	1.77	1.78	1.77	1.75	4.97
SHIPS & CONVERSIONS	3.30	2.95	3.10	3.38	3.22	3.24	3.44	0.72
AMMUNITION	0.89	0.86	0.96	1.02	1.08	1.18	1.27	6.10
OTHER	5.24	5.28	6.01	6.57	7.07	7.56	7.99	7.31
RESEARCH & DEVELOPMENT	10.28	10.08	10.50	10.60	10.58	10.36	10.32	0.07
MILITARY CONSTRUCTION	2.56	2.60	2.86	3.00	3.19	3.35	3.45	5.08
TOTAL	100.00	100.00	100.00	100.00	100.00	100.00	100.00	0.00

TABLE II.3: FORECAST OF TOTAL EMPLOYMENT BY INDUSTRY
(THOUSANDS OF PERSONS EXCEPT AS NOTED)

INDUSTRY	1981		1987		AVG. ANN. % GROWTH		NET NEW EMPLOYMENT		DEFENSE SHARE OF GROWTH
	TOTAL	DEFENSE	TOTAL	DEFENSE	TOTAL	DEFENSE	TOTAL	DEFENSE	
TOTAL, ALL INDUSTRIES	89,960.9	3,821.7	97,165.2	5,302.1	1.3	5.6	7,204.3	1,480.4	20.5
NONFERROUS METAL MINING	67.6	[illegible].3	68.2	6.8	0.1	8.2	0.5	2.6	473.0
COAL MINING	263.[illegible]	10.0	304.9	15.1	2.5	7.2	41.8	5.1	12.3
CRUDE PETROLEUM & N. GAS	600.0	31.1	561.0	38.4	-1.[illegible]	3.6	-39.0	7.3	NM
STONE&CLAY MINING & QUARRYING	93.8	3.3	97.3	5.4	0.6	8.3	3.4	2.0	58.8
CONSTRUCTION	4,458.8	131.0	4,851.0	212.6	1.4	8.4	392.2	81.6	20.8
ORDNANCE & ACCESSORIES	227.4	153.6	318.2	242.6	5.8	7.9	90.8	89.0	98.0
FOOD & KINDRED PRODUCTS	1,707.2	48.2	1,706.1	52.7	0.0	1.5	-1.2	4.5	NM
TOBACCO MANUFACTURES	70.7	1.5	64.3	1.5	-1.6	-0.9	-6.3	-0.1	NM
FABRIC,YARN & THREAD MILLS	503.9	16.4	471.3	17.4	-1.1	1.1	-32.6	1.1	NM
MISC. TEXTILE GOODS	116.7	3.2	123.5	3.9	1.0	3.5	6.9	0.7	10.7
APPAREL	1,319.1	36.1	1,403.9	40.4	1.0	1.9	84.8	4.3	5.1
MISC. FABRICATED TEXTILE PROD.	183.8	8.6	185.3	10.0	0.1	2.6	1.5	1.4	95.3
LUMBER & WOOD PRODUCTS	637.5	14.7	690.9	22.1	1.3	6.9	53.4	7.3	13.7
HOUSEHOLD FURNITURE	313.3	8.8	339.6	10.5	1.4	2.9	26.3	1.6	6.2
OTHER FURNITURE & FIXTURES	164.9	2.7	170.7	3.8	0.6	5.8	5.8	1.1	18.7
PAPER & ALLIED PRODUCTS	493.5	16.4	495.9	20.7	0.1	4.0	2.4	4.3	183.0
PAPERBOARD CONTAINERS & BOXES	204.1	7.8	212.9	10.5	0.7	5.[illegible]	8.8	2.7	30.4
PRINTING & PUBLISHING	1,294.1	39.8	1,319.9	50.8	0.3	4.2	25.8	11.0	42.7
CHEMICALS & PRODUCTS	499.6	22.8	492.1	32.0	-0.3	5.8	-7.5	9.2	NM
PLASTICS & SYNTHETIC MATLS.	208.6	7.8	206.4	10.4	-0.2	4.9	-2.1	2.6	NM
DRUGS,CLEANING & TOILET PREP.	341.2	7.8	352.8	8.7	0.6	1.7	11.6	0.8	7.3
PAINTS & ALLIED PRODUCTS	65.9	3.3	72.6	5.0	1.6	7.3	6.6	1.7	26.0
PET REFINING & REL. PROD.	209.3	11.0	206.8	14.1	-0.2	4.2	-2.6	3.1	NM
RUBBER & MISC. PLASTICS PROD.	719.2	28.7	793.1	43.7	1.6	7.2	73.8	15.0	20.3
FOOTWEAR & OTHER LEATHER PROD.	220.2	5.6	201.7	5.[illegible]	-1.5	-0.5	-18.5	-0.2	NM
GLASS & GLASS PRODUCTS	187.6	6.7	197.9	9.6	0.9	6.2	10.3	2.9	28.5
STONE & CLAY PRODUCTS	468.1	14.5	471.3	22.8	0.1	7.8	3.2	8.2	256.2
PRIMARY FERROUS METALS	723.7	43.4	735.7	66.8	0.3	7.4	12.1	23.4	194.1
NONFERROUS METALS	420.1	29.3	436.9	47.[illegible]	0.7	8.2	16.8	17.7	105.1
METAL CONTAINERS	76.9	2.4	75.5	2.[illegible]	-0.3	2.3	-1.4	0.4	NM
FAB. STRUCTURAL METAL PRODUCTS	744.0	27.4	755.5	44.8	0.3	8.6	11.5	17.4	151.5
SCREW MACHINE PROD.&STAMPINGS	382.1	21.8	382.6	32.1	0.0	6.7	0.5	10.3	1,962.0
OTHER FAB. METAL PRODUCTS	365.2	17.6	387.9	28.5	1.0	8.4	22.8	10.9	47.9
ENGINES & TURBINES	125.8	7.7	122.6	11.9	-0.4	7.4	-3.3	4.1	NM

TABLE II.3: FORECAST OF TOTAL EMPLOYMENT BY INDUSTRY (CONTINUED)
(THOUSANDS OF PERSONS EXCEPT AS NOTED)

INDUSTRY	1984		1987		AVG. ANN. % GROWTH		NET NEW EMPLOYMENT		DEFENSE SHARE OF GROWTH
	TOTAL	DEFENSE	TOTAL	DEFENSE	TOTAL	DEFENSE	TOTAL	DEFENSE	
TOTAL, ALL INDUSTRIES	89,960.9	3,821.7	97,165.2	5,302.1	1.3	5.6	7,204.3	1,480.4	20.5
FARM & GARDEN MACHINERY	155.3	0.8	133.8	1.0	-2.5	2.9	-21.5	0.2	NM
CONSTR. & MINING MACHINERY	289.2	3.2	270.9	4.5	-1.1	5.9	-18.3	1.3	NM
MATERIALS HANDLING MACH. & EQ.	100.5	4.6	105.1	7.5	0.8	8.6	4.6	2.9	63.1
METALWORKING MACH. & EQ.	360.3	15.8	376.6	26.4	0.7	9.0	16.3	10.6	65.0
SPECIAL INDUSTRY MACHINERY	198.1	1.4	218.4	2.2	1.6	8.7	20.3	0.9	4.4
GENERAL INDUSTRY MACHINERY	317.0	12.2	310.7	18.3	-0.3	6.9	-6.3	6.1	NM
MISC. NONELECTRICAL MACH.	281.5	25.0	277.4	37.3	-0.2	6.9	-4.1	12.3	NM
OFFICE,COMPUTING & ACCT. MACH.	434.4	14.8	456.7	23.8	0.8	8.3	22.3	9.0	40.4
SERVICE INDUSTRY MACHINES	172.3	4.0	192.2	7.0	1.8	9.9	19.9	3.0	15.2
ELECTRICAL MACHINERY	353.1	15.6	360.3	24.8	0.3	8.0	7.2	9.2	127.7
HOUSEHOLD APPLIANCES	163.8	3.3	164.1	3.6	0.0	1.4	0.4	0.3	82.1
ELECTRIC LIGHTING & WIRING EQ.	220.7	10.0	223.6	15.4	0.2	7.5	2.9	5.4	187.4
RADIO,TV, & COMMUNICATION EQ.	670.5	206.6	833.9	332.4	3.7	8.2	163.4	125.8	77.0
ELECTRONIC COMPONENTS & ACCESS.	543.6	85.1	699.3	157.9	4.3	10.9	155.7	72.8	46.8
MISC. ELECTRICAL MACH. & EQ.	171.3	6.6	180.9	9.8	0.9	6.8	9.6	3.2	33.5
MOTOR VEHICLES & EQUIPMENT	782.3	23.0	834.3	36.2	1.1	7.9	52.0	13.2	25.4
AIRCRAFT & PARTS	643.6	253.4	763.0	394.7	2.9	7.7	119.4	141.3	118.4
OTHER TRANSPORTATION EQ.	287.9	49.2	296.5	59.2	0.5	3.1	8.6	10.1	117.2
INSTRUMENTS & SUPPLIES	484.2	52.5	576.1	84.4	2.9	8.3	91.9	32.0	34.8
OPTICAL,OPHTHALMIC & PHOTO EQ.	214.5	9.5	229.9	14.1	1.2	6.9	15.4	4.7	30.3
MISC. MANUFACTURING	428.9	11.3	446.9	13.3	0.7	2.8	18.1	2.1	11.4
TRANSPORTATION & WAREHOUSING	3,603.6	200.6	3,834.7	258.3	1.0	4.3	231.0	57.8	25.0
COMMUNICATION EXC. RADIO & TV	1,192.8	48.3	1,333.9	63.8	1.9	4.7	141.1	15.4	10.9
RADIO & TV BROADCASTING	203.8	7.3	227.3	10.3	1.8	6.0	23.5	3.1	13.0
UTILITIES	839.5	33.0	836.4	41.9	-0.1	4.1	-3.1	8.9	NM
WHOLESALE & RETAIL TRADE	15,991.3	470.3	17,568.9	617.9	1.6	4.7	1,577.6	147.6	9.4
FINANCE & INSURANCE	4,224.6	120.0	4,672.7	154.4	1.7	4.3	448.1	34.4	7.7
REAL ESTATE & RENTAL	1,025.2	29.0	1,075.2	34.3	0.8	2.9	49.9	5.3	10.7
PERSONAL SERVICES EXC. AUTO.	2,262.0	101.7	2,388.3	134.9	0.9	4.8	126.4	33.2	26.3
BUSINESS SERVICES	3,084.8	151.3	3,551.0	233.6	2.4	7.5	466.3	82.3	17.6
EATING & DRINKING PLACES	4,831.2	194.5	5,134.5	259.2	1.0	4.9	303.4	64.7	21.3
AUTOMOBILE REPAIR & SERVICE	581.0	20.1	602.5	25.1	0.6	3.8	21.5	5.0	23.2
AMUSEMENTS	953.9	29.7	1,063.1	37.0	1.8	3.8	109.2	7.4	6.7
MISC. SERVICES	18,563.7	547.7	20,189.7	642.0	1.4	2.7	1,626.0	94.2	5.8
SELF-EMPLOYED & UNPAID FAMILY WORKERS	6,731.6	258.8	7,339.3	355.7	1.5	5.4	607.7	96.9	15.9

percent per year), Electronic Components (4.3 percent per year), Communications Equipment (3.7), Aircraft and Parts (2.9), Instruments and Supplies (2.9) and Business Services (2.4).

In terms of absolute increases, employment in the following industries will expand the most between 1981 and 1987:

Industry	Net Increase in Employment (Thousands)
Miscellaneous Services	1626.0
Wholesale and Retail Trade	1577.6
Business Services	466.3
Finance and Insurance	448.1
Construction	392.2
Eating and Drinking Places	303.4
Transportation and Warehousing	231.0
Radio & TV Communication Equipment	163.4
Electronic Components and Accessories	155.7
Communication Equipment except Radio and TV	141.1

Hence, most new jobs will be in service industries, construction and electronic equipment manufacturing. New employment in the ten industries listed above will account for over 75 percent of total new employment between 1981 and 1987.

The growth in defense-related employment by industry is particularly dramatic. In many industries (38 out of 72) employment for Defense is projected to grow at average annual rates in excess of 5 percent. Clearly, the defense share of total employment in each industry will increase rapidly, and in many industries, employment for defense will make up over 50 percent of total new employment. These include several mining industries, ordnance and accessories, petroleum refining, primary metals, fabricated structural metals, screw machine products and stampings, materials handling machinery and equipment, electrical machinery, communications equipment, aircraft and other transportation equipment. In a number of industries total employment is projected to decline while defense-related employment is projected to increase, indicating that in the absence of increased growth in

expenditures for defense, employment in these industries would decline more rapidly.

About half of defense-related new employment will be in ten of the 72 industries analyzed. these include Business Services (162 thousand new jobs), Aircraft and Parts (115 thousand), Communication Equipment (130 thousand), Ordnance (109 thousand), New and Maintenance Construction (118 thousand) and Electronic Components (70 thousand). In two of these industries (Aircraft and Ordnance) over 100 percent of net new jobs will be defense oriented. Clearly these trends will have significant impact on the demands for selected skills.

C. National Employment Growth by Occupation

The patterns of growth in total employment by each industry dictate the forecasts of total employment by occupation. Rapid growth in the so-called "high tech" industries suggests rapid increases in the demand for highly skilled occupations. Slow growth in the demand for educational services suggests slow growth or decline in the demand for teachers. The implications of the employment forecasts discussed above on the demand for occupations by major group and selected individual occupations are summarized in Table II.4. A complete national forecast for 163 occupation categories is provided in Section IV.

Among major groups of occupations employment of Computer and Peripheral Equipment Operators and Computer Specialists is projected to grow the fastest, at average annual rates of 5.0 percent and 4.6 percent respectively. This growth will not be isolated in a few industries but spread out across all industries as computer technology plays an increasingly greater role in the conduct of business. Engineers as a major group can also expect robust growth in demand, with total employment growth of 2.9 percent per year. Growth in employment of health workers measures 2.8 percent per year. Each of these 4 major groups will experience employment growth at rates more than double that of total employment.

In terms of absolute growth, many new jobs will be office-oriented. The ranks of clerical workers other than secretaries and office equipment operators will swell by

TABLE II.4: SUMMARY FORECAST OF NATIONAL EMPLOYMENT BY OCCUPATION
(THOUSANDS OF PERSONS EXCEPT AS NOTED)

OCCUPATION	1981		1987		AVG. ANN. % GROWTH		NET NEW EMPLOYMENT		DEFENSE SHARE OF GROWTH
	TOTAL	DEFENSE	TOTAL	DEFENSE	TOTAL	DEFENSE	TOTAL	DEFENSE	
TOTAL, ALL OCCUPATIONS	89,960.9	3,821.7	97,165.2	5,302.1	1.3	5.6	7,204.3	1,480.4	20.5
ENGINEERS	1,032.9	124.7	1,223.1	210.3	2.9	9.1	190.2	85.6	45.0
AERO-ASTRONAUTIC ENGINEERS	61.0	25.8	89.5	48.6	6.6	11.2	28.6	22.8	80.0
CIVIL ENGINEERS	97.9	3.7	112.0	5.2	2.3	5.8	14.1	1.5	10.6
ELECTRICAL ENGINEERS	304.7	37.4	380.1	65.1	3.8	9.7	75.4	27.7	36.7
INDUSTRIAL ENGINEERS	111.5	9.7	125.1	15.7	1.9	8.3	13.7	6.0	43.8
MECHANICAL ENGINEERS	202.4	17.6	232.9	29.2	2.4	8.8	30.5	11.6	38.0
PETROLEUM ENGINEERS	19.2	1.0	22.7	1.5	2.8	7.6	3.5	0.5	15.7
ALL OTHER ENGINEERS	161.9	24.9	178.2	37.7	1.6	7.1	16.3	12.8	78.3
SCIENTISTS NEC	218.2	11.3	241.0	16.3	1.7	6.3	22.7	5.0	22.1
MATHEMATICAL SPECIALISTS NEC	9.8	0.4	12.0	0.6	3.4	6.5	2.2	0.2	8.4
ENGINEERING&SCIENCE TECHNICIANS	1,050.0	74.4	1,201.7	117.6	2.3	7.9	151.8	43.3	28.5
DRAFTERS	303.9	16.7	346.0	25.9	2.2	7.5	42.1	9.1	21.7
ELECTRICAL&ELECTRONIC TECHNICIANS	337.9	28.5	401.6	47.2	2.9	8.8	63.7	18.7	29.4
ENGINEERING&SCIENCE TECH NEC	308.6	18.8	340.4	28.0	1.6	6.8	31.8	9.2	28.8
HEALTH WORKERS	3,185.1	96.2	3,760.5	124.3	2.8	4.4	575.3	28.1	4.9
DENTISTS	172.1	5.1	211.5	6.7	3.5	4.8	39.4	1.7	4.2
PROFESSIONAL NURSES	1,038.9	31.4	1,310.7	42.9	3.9	5.4	271.8	11.5	4.2
PHYSICIANS, MEDICAL&OSTEOPATHIC	448.8	13.4	542.1	17.5	3.2	4.6	93.3	4.1	4.4
ALL OTHER HEALTH PROFESSIONALS	217.6	6.4	240.0	8.1	1.6	4.1	22.4	1.7	7.8
OTHER HEALTH WORKERS	1,307.7	40.0	1,456.2	49.0	1.8	3.5	148.4	9.0	6.1
TECHNICIANS NEC	200.7	12.8	216.5	18.0	1.2	5.9	15.8	5.2	33.2
COMPUTER SPECIALISTS	393.9	22.2	515.4	39.9	4.6	10.2	121.5	17.6	14.5
COMPUTER PROGRAMMERS	217.0	11.3	271.0	19.0	3.8	9.0	54.1	7.6	14.1
COMPUTER SYSTEMS ANALYSTS	176.9	10.9	244.4	20.9	5.5	11.5	67.4	10.0	14.8
SOCIAL SCIENT.&OTHER PROFESSIONALS	8,415.8	312.8	8,356.0	381.1	-0.1	3.3	-59.8	68.3	NM
ECONOMISTS	15.7	0.9	18.4	1.4	2.7	8.1	2.7	0.5	20.0
SOCIAL SCIENTISTS NEC	113.2	4.3	128.5	5.8	2.1	5.1	15.3	1.5	9.7
ALL OTHER TEACHERS	892.5	27.3	958.4	32.1	1.2	2.7	65.9	4.8	7.3
WRITERS, ARTISTS & ENTERTAINERS	926.0	42.4	992.3	58.6	1.2	5.5	66.3	16.2	24.4
PROFESSIONAL&TECH WORKERS NEC	3,555.3	151.8	3,965.0	210.1	1.8	5.6	409.7	58.3	14.2
BUSINESS PROFESSIONALS&STAFF	32,569.0	1,239.6	35,606.3	1,684.5	1.5	5.2	3,037.3	444.9	14.6
MANAGERS, OFFICIALS&PROPRIETORS	8,521.1	346.0	9,232.9	473.2	1.3	5.4	711.8	127.2	17.9
SALES WORKERS	6,870.8	216.9	7,508.2	288.5	1.5	4.9	637.5	71.7	11.2
CLERICAL WORKERS	17,177.1	676.8	18,865.1	922.7	1.6	5.3	1,688.0	246.0	14.6
COMPUTER&PERIPHERAL EQUIP. OPER.	223.8	10.3	299.3	17.2	5.0	8.8	75.5	6.8	9.0
COMPUTER OPERATORS	173.2	8.0	236.8	13.6	5.3	9.4	63.6	5.7	8.9
PERIPHERAL EDP EQUIP. OPERATORS	50.5	2.4	62.4	3.5	3.6	6.9	11.9	1.2	9.8
SECRETARIES&OFFICE MACH. OPS NEC	3,858.7	156.0	4,312.3	218.6	1.9	5.8	453.6	62.7	13.8
CLERICAL WORKERS NEC	13,094.6	510.5	14,253.6	686.9	1.4	5.1	1,159.0	176.5	15.2

TABLE II.4: SUMMARY FORECAST OF NATIONAL EMPLOYMENT BY OCCUPATION (CONTINUED)
(THOUSANDS OF PERSONS EXCEPT AS NOTED)

OCCUPATION	1981		1987		AVG. ANN. % GROWTH		NET NEW EMPLOYMENT		DEFENSE SHARE OF GROWTH
	TOTAL	DEFENSE	TOTAL	DEFENSE	TOTAL	DEFENSE	TOTAL	DEFENSE	
TOTAL, ALL OCCUPATIONS	89,960.9	3,821.7	97,165.2	5,302.1	1.3	5.6	7,204.3	1,480.4	20.5
CRAFT&RELATED WORKERS	11,108.5	517.3	11,892.5	749.1	1.1	6.4	784.0	231.8	29.6
CONSTRUCTION CRAFTS WORKERS	2,865.2	106.0	3,075.0	160.7	1.2	7.2	209.8	54.7	26.1
ELECTRICIANS	510.5	22.8	539.5	33.8	0.9	6.8	29.0	11.1	38.1
PLUMBERS&PIPEFITTERS	373.0	15.8	402.0	23.6	1.3	6.9	28.9	7.8	27.0
CONSTRUCTION CRAFTS WORKERS, NEC	1,890.5	63.7	2,038.3	97.7	1.3	7.4	147.8	34.0	23.0
MECHANICS, REPAIRERS&INSTALLERS	3,603.9	149.5	3,955.3	208.9	1.6	5.7	351.5	59.4	16.9
AIRCRAFT MECHANICS	77.4	10.6	88.7	16.4	2.3	7.6	11.4	5.8	51.4
AUTO MECHANICS&REPAIRERS	970.3	32.6	1,083.3	44.4	1.9	5.3	113.0	11.8	10.4
DATA PROCESSING MACHINE MECHANICS	88.5	3.6	131.0	6.7	6.8	11.0	42.5	3.1	7.3
DIESEL MECHANICS	163.2	6.6	179.0	9.0	1.5	5.2	15.8	2.4	15.0
ELECTRIC MOTOR REPAIRERS	20.6	1.0	26.0	1.6	3.9	8.3	5.4	0.6	11.0
MAINT. MECH&REPAIRERS GEN UTIL	891.1	37.9	953.3	53.1	1.1	5.8	62.2	15.1	24.3
TELEPHONE INSTALLERS&REPAIRERS	253.3	10.3	277.6	13.3	1.5	4.4	24.3	3.0	12.4
MECHANICS REPAIRERS INSTALL. NEC	930.1	35.7	996.6	48.1	1.2	5.1	66.5	12.4	18.6
METALWORKING CRAFTS WORKERS	884.0	60.6	915.7	91.1	0.6	7.0	31.7	30.5	96.2
MACHINISTS	257.7	18.1	272.0	26.6	0.9	6.7	14.3	8.5	59.8
OTHER CRAFT&RELATED WORKERS	3,355.9	187.4	3,549.3	270.6	0.9	6.3	193.4	83.1	43.0
BLUE COLLAR WORKER SUPERVISORS	1,207.7	67.5	1,279.5	96.9	1.0	6.2	71.8	29.4	40.9
HEAVY EQUIPMENT OPERATORS	342.8	11.1	358.2	16.8	0.7	7.1	15.4	5.6	36.5
INSPECTORS	469.5	41.7	501.7	62.5	1.1	7.0	32.2	20.8	64.7
LENS GRINDERS	11.0	0.5	12.9	0.9	2.6	8.5	1.9	0.3	18.0
CRAFT&RELATED WORKERS, NEC	1,173.1	51.9	1,236.0	71.7	0.9	5.5	62.9	19.9	31.4
OPERATIVES	13,867.6	728.8	14,594.7	1,044.7	0.9	6.2	727.1	315.9	43.5
ASSEMBLERS	1,660.9	163.6	1,823.3	259.4	1.6	8.0	162.4	95.8	59.0
AIRCRAFT STRUCTURE&SURFACE ASSEMB	25.0	10.3	29.6	15.9	2.9	7.5	4.6	5.6	120.1
ELECTRICAL&ELECTRONIC ASSEMBLERS	231.1	33.4	262.5	54.3	2.1	8.5	31.4	20.9	66.7
INSTRUMENT MAKERS&ASSEMBLERS	24.8	2.7	28.9	4.4	2.6	8.3	4.2	1.7	39.7
ASSEMBLERS, NEC	1,221.5	104.3	1,335.2	164.5	1.5	7.9	113.7	60.2	52.9
METALWORKING OPERATIVES	1,620.7	120.5	1,694.0	184.2	0.7	7.3	73.4	63.7	86.8
WELDERS&FLAMECUTTERS	553.3	33.4	576.7	48.9	0.7	6.6	23.4	15.6	66.5
ALL OTHER OPERATIVES	10,586.1	444.7	11,077.4	601.2	0.8	5.2	491.3	156.5	31.8
WIRERS, ELECTRONIC	30.8	6.0	36.7	9.9	3.0	8.6	5.9	3.9	66.2
OPERATIVES, NEC	10,211.4	416.4	10,677.9	557.5	0.7	5.0	466.5	141.1	30.2
SERVICE WORKERS	12,901.0	484.2	14,245.6	644.0	1.7	4.9	1,344.6	159.8	11.9
FOOD SERVICE WORKERS	6,125.8	232.1	6,548.8	302.7	1.1	4.5	423.0	70.7	16.7
SELECTED HEALTH SERVICE WORKERS	1,411.3	41.9	1,805.8	57.8	4.2	5.5	394.5	16.0	4.1
PROTECTIVE SERVICE WORKERS	680.4	32.7	744.1	46.2	1.5	5.9	63.7	13.5	21.2
SERVICE WORKERS, NEC	4,683.6	177.6	5,147.0	237.2	1.6	4.9	463.4	59.6	12.9
LABORS, EXCEPT FARM	5,018.2	197.4	5,312.1	272.3	1.0	5.5	293.8	74.9	25.5

over a million. The number of Managers, Officials and Proprietors will grow over 700 thousand and the number of secretaries will increase by 450 thousand. Many new jobs will also be available for equipment operators and health workers.

With regard to more specific occupation categories, the forecast shows very rapid growth in demand for Data Processing Machine Mechanics (6.8 percent per year), Aero-Astronautic Engineers (6.6 percent per year) Computer Operators (5.3 percent) and Computer Systems Analysts (5.5). Other rapidly growing occupations include Electric Motor Repairers, Computer Programmers, Economists, Electrical Engineers, Selected Health Service Workers, and Peripheral EDP Equipment Operators. Each of these occupations will experience employment growth at rates substantially greater than that of total employment.

The role of defense in shaping these trends is evident in Table II.4. In 18 of the individual occupation categories shown, more than one-third of total net new employment will be defense-related, and in 10 of these over half of total new employment will be defense-related. In almost every category, growth in employment for defense will be greater than 5 percent per year, and in 4 categories employment growth will top 10 percent per year. Much of the increase in defense-related employment can be seen in occupations associated with the operation of equipment, particularly Assemblers, Metalworking Operatives and Other Operatives. Large absolute increases in the defense-related employment of Clerical Workers, NEC and Managers, Officials and Proprietors are also forecast. Out of 190 thousand new jobs for engineers, 86 thousand will be defense-oriented. The number of jobs for construction workers will also be significantly affected by the defense buildup.

The fastest growing individual occupations for defense include 4 computer-oriented occupations and 3 engineering occupations. Defense initiatives will also require rapid growth in defense-oriented employment of electrical and electronic technicians, electronic wirers, lens grinders, and electrical and electronic assemblers. About 80 percent of net new Aero-astronautic Engineers and about 37 percent of net new Electrical Engineers will be required to satisfy defense needs. Across all occupations, defense impacts will account for over 20 percent of net new employment in the private sector.

D. Regional Impacts on Employment by Occupation by State and Selected Metropolitan Areas

The sheer quantity of data involved in the forecasts precludes discussion in this report of all occupations in all regions. Hence only the occupations and regions most affected by national trends, and referred to in the Executive Summary are addressed here. However, detailed projections for each state and each of 70 metropolitan areas may be found in Volume 2.

As discussed in the Executive Summary, estimates of regional employment by occupation were analyzed with respect to rates of growth and the role of employment for defense in that growth. On the basis of this analysis, an occupation was deemed of potentially critical significance if the growth rate of total regional employment is projected to exceed the national rate of employment growth by a factor of 2 or more and the region growth rate in defense-related employment is projected to exceed the growth rate of total regional employment by a factor of 2 or more. Those occupations for which fewer than 1000 net new jobs are projected nationally were not considered further. While these criteria are subjective, they serve to isolate trends as candidates for further analysis and consideration.

The selection criteria suggest that potential shortages may occur for 32 skilled occupations, including 9 professional and technical occupations, 11 craft occupations, and 11 occupations associated with the operation of equipment. At the state level, rapid growth in the employment of various engineering occupations will occur in 14 states, as shown in Table II.5. Among other professional and technical workers, rapid employment growth is projected for Drafters in California and Texas; Electrical and Electronic Technicians in California, Connecticut, Florida, Maryland, Massachusetts, New Jersey, and Texas; Mechanical Engineering Technicians in California and Connecticut; Computer Programmers in California, New York and Texas; and Systems Analysts in Connecticut and New York.

In most cases, this growth is spurred in large part by expenditures for defense. With few exceptions large fractions of net new employment of these selected occupations in the states shown will be defense related. Virtually all new jobs for Aero-astronautic Engineers in Ohio and Pennsylvania will be associated with supplying defense needs. Over half of the new jobs for Electrical Engineers in Indiana will be

TABLE II.5: FORECAST OF EMPLOYMENT OF SELECTED PROFESSIONAL AND TECHNICAL WORKERS IN SELECTED STATES
(THOUSANDS OF PERSONS EXCEPT AS NOTED)

OCCUPATION/REGION	19		1987		AVG. ANN. % GROWTH		NET NEW EMPLOYMENT		DEFENSE SHARE OF GROWTH (%)
	TOTAL	DEFENSE	TOTAL	DEFENSE	TOTAL	DEFENSE	TOTAL	DEFENSE	
AERO-ASTRONAUTIC ENGINEERS									
OHIO	2.7	1.0	3.5	1.7	4.5	10.3	0.8	0.8	94.1
PENNSYLVANIA	2.0	0.1	2.5	1.5	4.1	8.4	0.5	0.6	108.1
WASHINGTON	4.4	0.[illegible]	5.8	1.6	4.4	9.7	1.3	0.7	51.1
ELECTRICAL ENGINEERS									
ARIZONA	5.3	0.7	7.2	1.3	5.2	11.2	1.9	0.6	32.7
CONNECTICUT	6.4	0.9	8.1	1.7	4.1	10.0	1.7	0.7	42.2
INDIANA	8.8	1.0	10.4	1.8	2.7	9.9	1.6	0.8	51.0
MASSACHUSETTS	15.1	2.3	19.7	4.1	4.5	10.0	4.6	1.8	38.7
MINNESOTA	7.7	0.8	9.1	1.4	2.9	9.2	1.4	0.6	39.6
NEW JERSEY	11.2	1.3	13.8	2.3	3.6	9.9	2.6	1.0	38.0
NEW YORK	27.5	3.6	32.9	6.0	3.0	9.0	5.4	2.4	45.0
TEXAS	20.2	2.4	26.5	4.4	4.6	10.4	6.3	2.0	31.3
VIRGINIA	5.7	1.1	7.3	1.8	4.2	8.9	1.6	0.7	44.1
INDUSTRIAL ENGINEERS									
CALIFORNIA	13.6	2.0	16.8	3.5	3.6	9.4	3.2	1.5	45.0
MECHANICAL ENGINEERS									
CALIFORNIA	23.7	3.7	30.2	6.5	4.1	9.7	6.5	2.8	42.6
CONNECTICUT	5.3	0.9	6.7	1.8	4.0	11.0	1.4	0.8	59.0
FLORIDA	6.5	0.7	8.5	1.3	4.5	11.0	2.0	0.6	30.5
MASSACHUSETTS	7.1	0.8	8.8	1.2	3.7	8.7	1.7	0.5	28.6
TEXAS	14.3	1.2	17.3	2.0	3.2	9.2	3.0	0.8	27.7
ALL OTHER ENGINEERS									
CALIFORNIA	24.8	6.4	30.1	10.1	3.3	8.0	5.3	3.7	70.7
CONNECTICUT	5.5	1.5	6.5	2.5	2.9	8.7	1.0	1.0	96.5
FLORIDA	5.7	1.1	7.3	1.9	4.4	9.4	1.7	0.8	47.5
DRAFTERS									
CALIFORNIA	33.5	2.9	41.5	4.8	3.6	8.8	8.0	1.9	23.5
TEXAS	22.4	1.1	27.1	1.8	3.2	8.1	4.6	0.7	14.6
ELECTRICAL&ELECTRONIC TECHNICIANS									
CALIFORNIA	49.6	6.3	64.2	11.1	4.4	9.8	14.6	4.8	32.5
CONNECTICUT	6.6	0.8	8.0	1.4	3.3	9.8	1.4	0.6	42.2
FLORIDA	14.6	1.2	19.3	2.2	4.8	10.3	4.8	1.0	21.0
MASSACHUSETTS	14.1	1.6	17.4	2.7	3.6	9.1	3.3	1.1	32.9
MARYLAND	5.8	0.8	7.1	1.4	3.5	8.8	1.3	0.6	41.9
NEW JERSEY	11.8	0.9	13.9	1.5	2.8	8.8	2.1	0.6	29.1
TEXAS	23.9	1.9	30.0	3.2	3.8	9.5	6.1	1.3	22.2
MECHANICAL ENGINEERING TECHNICIANS									
CALIFORNIA	7.0	1.7	9.1	3.0	4.3	9.5	2.0	1.2	61.2
CONNECTICUT	2.0	0.6	2.5	1.0	4.0	10.1	0.5	0.5	85.2
ENGINEERING&SCIENCE TECH NEC									
CALIFORNIA	32.9	3.4	39.6	5.5	3.1	8.3	6.6	2.1	31.3
FLORIDA	10.2	0.7	12.3	1.2	3.2	8.6	2.1	0.5	21.4
ALL OTHER TECHNICIANS NEC									
CALIFORNIA	8.6	0.9	10.2	1.4	2.8	7.5	1.6	0.5	31.7
COMPUTER PROGRAMMERS									
CALIFORNIA	28.8	2.0	38.6	3.6	5.0	10.0	9.8	1.6	16.1
NEW YORK	21.8	1.1	26.2	1.8	3.1	8.3	4.3	0.7	15.6
TEXAS	15.4	0.8	20.2	1.4	4.6	9.8	4.8	0.6	12.3
COMPUTER SYSTEMS ANALYSTS									
CONNECTICUT	3.5	0.4	4.9	0.8	6.0	14.0	1.5	0.5	31.1
NEW YORK	16.8	1.0	22.1	1.8	4.6	10.4	5.3	0.8	14.9

defense related, as will 45 percent and 42 percent of the new jobs in New York and Connecticut respectively. Large increases in the numbers of Industrial Engineers, Mechanical Engineers and Other Engineers are forecast for California, where over 40 percent of the new jobs in these occupations will be defense-related. Mechanical Engineers will also be in high demand in Connecticut, Florida, Massachusetts and Texas. The aerospace industry, manufacturers of electronic equipment (particularly communications equipment), and producers of ordnance and accessories are the primary sources of new jobs for professional and technical occupations in these states. Other sources of new employment for engineers and technicians include the construction industry and business services.

Table II.6 shows the forecast for 10 states in which employment growth for selected crafts and kindred workers will be especially rapid. Almost all of the growth in employment of Aircraft Mechanics and Inspectors in Connecticut will be defense-related, as will about half the new jobs for Inspectors and Testers in California. Florida will see significant increases in demand for Blue Collar Worker Supervisors and Inspectors, and Texas will experience growing demands for Electricians, plumbers and other construction crafts workers, aircraft and auto mechanics, and sheet metal workers. Connecticut's aircraft industry is the source of growth in demand for Aircraft Mechanics, and in Florida's demand for Blue Collar Worker Supervisors can be traced primarily to rapid growth in new construction, wholesale and retail trade and electronic equipment. The latter industry is the primary source of new employment for Inspectors in the three states shown and for Testers in California.

Rapid growth in state-level employment of selected operative occupations is more geographically dispersed, as can be seen in Table II.7. However, California, Connecticut, and Texas are the key states facing potential shortages. These three states will be the source of many new jobs for assemblers, particularly Electrical and Electronic Assemblers. California will also see a rapid growth in demand for metalworking occupations, particularly Drill Press and Boring Machine Operators, Electroplaters, Lathe Machine Opertors, Machine Tool Operators, Milling and Planning Machine Operators, and Filers, Grinders, Buffers and Chippers. In most cases, more than one out of every three new jobs will be defense-related, and in many cases over half the new jobs will be defense-related.

TABLE II.6: FORECAST OF EMPLOYMENT OF SELECTED CRAFTS AND KINDRED WORKERS IN SELECTED STATES (THOUSANDS OF PERSONS EXCEPT AS NOTED)

	1981		1987		AVG. ANN. % GROWTH		NET NEW EMPLOYMENT		DEFENSE SHARE OF
OCCUPATION/REGION	TOTAL	DEFENSE	TOTAL	DEFENSE	TOTAL	DEFENSE	TOTAL	DEFENSE	GROWTH (%)
ELECTRICIANS									
TEXAS	47.3	1.4	55.5	2.2	2.7	7.5	8.2	0.8	9.3
PLUMBERS&PIPEFITTERS									
CALIFORNIA	41.0	2.4	47.2	3.7	2.4	7.8	6.2	1.4	21.6
TEXAS	37.9	1.0	45.4	1.6	3.0	7.5	7.5	0.5	7.3
CONSTRUCTION CRAFTS WORKERS, NEC									
CALIFORNIA	212.0	9.7	243.6	15.4	2.3	8.1	31.6	5.7	18.2
COLORADO	32.8	[illegible]	39.6	1.9	3.2	8.4	6.8	0.7	10.5
CONNECTICUT	23.4	1.0	27.8	1.5	2.9	7.6	4.5	0.5	11.8
MASSACHUSETTS	41.8	1.3	48.2	1.9	2.4	6.2	6.5	0.6	8.8
NEW JERSEY	48.6	1.1	58.1	1.6	3.0	6.6	9.5	0.5	5.3
OKLAHOMA	23.9	0.8	30.9	1.3	4.4	8.8	7.0	0.5	7.6
TEXAS	199.3	4.3	240.2	6.7	3.2	7.9	40.9	2.5	6.0
VIRGINIA	46.2	1.9	53.4	2.5	2.5	4.9	7.2	0.6	8.6
AIRCRAFT MECHANICS									
CALIFORNIA	10.9	1.9	13.4	3.1	3.5	8.5	2.5	1.2	48.0
CONNECTICUT	3.1	1.1	4.0	1.9	4.4	10.4	0.9	0.9	93.7
TEXAS	6.1	1.0	7.3	1.5	3.0	7.8	1.2	0.5	46.4
AUTO MECHANICS&REPAIRERS									
CALIFORNIA	109.9	4.1	129.9	5.9	2.8	6.3	19.9	1.8	9.1
FLORIDA	46.0	1.5	55.2	2.2	3.1	6.3	9.3	0.7	7.3
TEXAS	71.8	2.3	84.9	3.3	2.8	6.1	13.1	1.0	7.6
MACH. TOOL SETTERS, METALWORKING									
CALIFORNIA	5.9	0.9	6.9	1.5	2.7	8.3	1.0	0.6	55.0
SHEET-METAL WORKERS&TINSMITHS									
TEXAS	19.2	0.8	22.2	1.3	2.5	7.8	3.0	0.5	15.0
INSPECTORS									
CALIFORNIA	53.2	8.2	61.9	13.0	2.5	7.9	8.6	4.8	55.6
CONNECTICUT	11.9	2.2	13.6	3.7	2.3	8.7	1.7	1.4	83.9
FLORIDA	11.4	1.5	14.1	2.5	3.5	9.0	2.6	1.0	38.2
TESTERS									
CALIFORNIA	12.8	2.2	15.6	3.7	3.3	9.0	2.8	1.5	53.2

TABLE II.7: FORECAST OF EMPLOYMENT OF SELECTED OPERATIVES IN SELECTED STATES
(THOUSANDS OF PERSONS EXCEPT AS NOTED)

OCCUPATION/REGION	1981		1987		AVG. ANN. % GROWTH		NET NEW EMPLOYMENT		DEFENSE SHARE OF GROWTH (%)
	TOTAL	DEFENSE	TOTAL	DEFENSE	TOTAL	DEFENSE	TOTAL	DEFENSE	
AIRCRAFT STRUCTURE&SURFACE ASSEMB									
CALIFORNIA	5.8	2.3	7.2	3.6	3.6	8.1	1.4	1.4	97.4
CONNECTICUT	3.1	1.3	4.0	2.3	4.2	9.4	0.9	0.9	110.3
ELECTRICAL&ELECTRONIC ASSEMBLERS									
ARIZONA	5.5	0.8	6.8	1.4	3.6	10.5	1.3	0.6	47.5
CALIFORNIA	43.5	7.9	54.0	13.5	3.6	9.2	10.4	5.5	53.1
CONNECTICUT	6.8	1.1	8.1	1.9	2.9	9.3	1.3	0.8	61.8
MARYLAND	3.0	1.1	3.7	1.6	3.8	7.6	0.7	0.6	79.2
MASSACHUSETTS	14.0	2.2	16.7	3.6	2.9	8.5	2.7	1.4	51.2
TEXAS	13.1	2.1	15.8	3.5	3.2	9.3	2.7	1.5	53.5
ELECRO-MECHANICAL EQUIP. ASSEMB.									
CALIFORNIA	9.1	1.6	11.2	2.7	3.6	9.1	2.1	1.1	52.1
ASSEMBLERS, NEC									
ALABAMA	15.7	1.0	18.6	1.6	2.9	8.8	2.9	0.6	21.6
ARIZONA	12.8	1.9	16.0	3.4	3.8	9.6	3.2	1.4	44.3
CALIFORNIA	147.7	23.3	178.9	38.8	3.2	8.9	31.1	15.5	49.8
COLORADO	13.3	1.6	15.7	2.5	2.8	8.2	2.4	1.0	40.0
FLORIDA	27.4	3.7	36.0	6.5	4.7	10.0	8.6	2.9	33.1
NEW HAMPSHIRE	8.6	0.8	10.0	1.3	2.6	8.9	1.4	0.5	37.1
TEXAS	57.8	5.5	68.6	9.2	2.9	8.8	10.8	3.6	33.7
VERMONT	4.5	0.6	5.9	1.2	4.7	11.3	1.4	0.5	38.3
DRILL PRESS&BORING MACH. OPER.									
CALIFORNIA	12.4	1.8	14.6	2.9	2.7	8.6	2.2	1.1	52.0
ELECTROPLATORS									
CALIFORNIA	5.2	0.7	6.4	1.2	3.4	9.9	1.2	0.5	46.0
LATHE MACHINE OPERATORS, METAL									
CALIFORNIA	15.9	2.3	18.6	3.8	2.7	8.5	2.8	1.5	53.2
MACHINE TOOL OPERATORS, COMB.									
CALIFORNIA	17.5	2.4	20.4	3.9	2.6	8.5	2.9	1.5	51.7
MACHINE TOOL OPER. NUMER. CONTROL									
CALIFORNIA	6.3	1.2	7.6	1.9	3.2	8.7	1.3	0.8	57.1
MILLING&PLANING MACHINE OPERATORS									
CALIFORNIA	8.4	1.9	10.1	3.1	3.1	8.3	1.7	1.2	69.6
CONNECTICUT	3.2	0.7	3.7	1.2	2.8	9.3	0.6	0.5	90.1
WELDERS&FLAMECUTTERS									
FLORIDA	16.3	0.9	19.8	1.5	3.3	9.4	3.5	0.6	18.5
FILERS, GRINDERS, BUFFERS&CHIPPERS									
CALIFORNIA	12.9	1.8	15.0	2.9	2.6	8.3	2.1	1.1	50.7
WINDING OPERATORS, NEC									
CALIFORNIA	6.3	0.9	7.9	1.7	3.9	10.2	1.6	0.7	45.3
OPERATIVES, NEC									
NEVADA	33.3	1.3	39.0	1.8	2.7	6.4	5.7	0.6	10.0

Tables II.8-II.10 show forecasts of employment for selected occupations in selected metropolitan areas. Among professional and technical occupations, the supply of particular engineering occupations may become critical in as many as 16 major metropolitan areas. Seattle will need a substantial increase in Aero-astronautic Engineers. Boston, Nassau-Suffolk, New York, Phoenix and San Jose will require many more Electrical Engineers and Los Angeles will need a significantly increased supply of Industrial Engineers and Other Engineers. These results are displayed in Table II.8. As can be seen, the rate of growth in employment of engineering occupations in these metropolitan areas exceeds the total national employment growth rate by several orders of magnitude, and the defense share of each is projected to rise sharply. Over 18 percent of net new jobs for electrical engineers will be located in the 5 cities shown, and from 30 to 67 percent of these jobs, depending on the city, will be required to satisfy defense needs. Los Angeles can expect to provide about 10 percent of all new jobs for Industrial Engineers and nearly 16 percent of all new jobs for Engineers, NEC. Nearly all of the latter will be to satisfy defense needs.

Los Angeles may face shortages in the supply of other professionals, including Drafters, Electrical and Electronic Technicians, Engineering and Science Technicians, NEC and Professional and Technical Workers, NEC. Anaheim, Dallas-Ft. Worth and San Jose will have many new jobs for Electrical and Electronic Technicians and Professional and Technical Workers, NEC. The latter occupation will also be in high demand in Denver, Houston, Phoenix, San Diego, San Francisco and Wichita, and Boston will see rapid increases in the demand for Electrical and Electronic Technicians.

Many of these same cities will be the source of rapid growth in the demand for selected craft workers and operatives as shown in Table II.9 and 10. Los Angeles will experience especially rapid growth in demand for each of the crafts occupations listed, and Dallas-Ft. Worth will experience rapid growth in three categories of crafts workers. These two metropolitan areas are also primary sources of new employment for equipment operators.

TABLE II.8: FORECAST OF EMPLOYMENT OF SELECTED PROFESSIONAL AND TECHNICAL WORKERS IN SELECTED METROPOLITAN AREAS (THOUSANDS OF PERSONS EXCEPT AS NOTED)

OCCUPATION/REGION	1981 TOTAL	1981 DEFENSE	1987 TOTAL	1987 DEFENSE	AVG. ANN. % GROWTH TOTAL	AVG. ANN. % GROWTH DEFENSE	NET NEW EMPLOYMENT TOTAL	NET NEW EMPLOYMENT DEFENSE	DEFENSE SHARE OF GROWTH (%)
AERO-ASTRONAUTIC ENGINEERS									
SEATTLE	4.3	0.9	5.6	1.6	4.5	9.7	1.3	0.7	51.2
ELECTRICAL ENGINEERS									
BOSTON	10.9	1.8	14.4	3.2	4.7	10.1	3.4	1.4	40.4
NASSAU-SUFFOLK	4.3	1.1	5.4	1.8	3.7	8.8	1.1	0.7	67.8
NEW YORK	9.4	0.9	11.3	1.4	3.0	8.5	1.9	0.6	30.0
PHOENIX	4.0	0.5	5.5	1.0	5.4	11.7	1.5	0.5	33.8
SAN JOSE	10.3	1.8	14.2	3.4	5.5	11.2	3.9	1.6	41.9
INDUSTRIAL ENGINEERS									
LOS ANGELES	4.5	1.1	5.8	1.8	4.4	9.3	1.3	0.7	57.3
MECHANICAL ENGINEERS									
DALLAS-FORT WORTH	3.2	0.6	4.1	1.1	4.6	10.1	1.0	0.5	47.8
ALL OTHER ENGINEERS									
DALLAS-FORT WORTH	3.5	1.0	4.1	1.5	2.7	7.3	0.6	0.5	83.0
HARTFORD	2.3	0.8	2.8	1.3	3.2	8.8	0.5	0.5	109.6
LOS ANGELES	9.9	3.5	12.5	5.6	3.9	8.0	2.6	2.1	80.7
DRAFTERS									
LOS ANGELES	10.7	1.3	13.3	2.1	3.7	8.6	2.6	0.8	31.0
ELECTRICAL&ELECTRONIC TECHNICIANS									
ANAHEIM	6.1	1.0	8.0	1.7	4.7	10.0	1.9	0.7	38.0
BOSTON	9.8	1.2	12.2	2.0	3.6	9.3	2.3	0.8	35.3
DALLAS-FORT WORTH	6.6	0.9	8.6	1.6	4.5	10.0	2.0	0.7	34.9
LOS ANGELES	15.2	2.5	20.0	4.4	4.6	9.5	4.7	1.9	39.2
SAN JOSE	9.4	1.3	12.4	2.4	4.8	10.6	3.0	1.1	35.9
ENGINEERING&SCIENCE TECH NEC									
LOS ANGELES	10.4	1.7	12.7	2.7	3.5	8.1	2.4	1.0	43.0
PROFESSIONAL&TECH WORKERS NEC									
ANAHEIM	31.5	2.4	37.8	3.7	3.1	7.3	6.3	1.3	20.5
DALLAS-FORT WORTH	53.5	3.5	63.1	5.2	2.8	6.8	9.6	1.7	17.5
DENVER	29.2	1.7	35.7	2.6	3.4	6.9	6.6	0.9	12.9
HOUSTON	45.9	1.8	54.0	2.5	2.7	5.8	8.1	0.7	9.1
LOS ANGELES	144.2	11.7	172.1	17.7	3.0	7.1	28.0	5.9	21.3
ORLANDO	10.6	0.9	13.0	1.5	3.5	8.7	2.5	0.6	24.0
PHOENIX	23.5	1.2	28.5	1.8	3.3	7.1	5.0	0.6	12.1
SAN DIEGO	23.9	1.7	28.4	2.5	2.9	6.9	4.5	0.8	18.3
SAN FRANCISCO	60.2	2.5	71.1	3.5	2.8	5.6	10.9	1.0	9.1
SAN JOSE	27.9	3.1	34.1	4.9	3.4	8.0	6.2	1.8	29.3
WICHITA	10.0	1.1	11.8	1.8	2.9	8.7	1.9	0.7	38.2

TABLE II.9: FORECAST OF EMPLOYMENT OF SELECTED CRAFTS AND KINDRED WORKERS IN SELECTED METROPOLITAN AREAS (THOUSANDS OF PERSONS EXCEPT AS NOTED)

	1981		1987		AVG. ANN. % GROWTH		NET NEW EMPLOYMENT		DEFENSE SHARE OF
OCCUPATION/REGION	TOTAL	DEFENSE	TOTAL	DEFENSE	TOTAL	DEFENSE	TOTAL	DEFENSE	GROWTH (%)
ELECTRICIANS									
LOS ANGELES	6.1	1.3	7.3	2.1	3.1	7.9	1.2	0.8	63.5
PLUMBERS&PIPEFITTERS									
LOS ANGELES	3.5	0.9	4.3	1.4	3.4	8.0	0.8	0.5	65.1
CONSTRUCTION CRAFTS WORKERS, NEC									
ANAHEIM	4.1	1.0	5.1	1.7	3.8	8.2	1.0	0.6	60.6
ATLANTA	4.3	1.1	5.2	1.8	3.4	8.5	0.9	0.7	72.5
DALLAS-FORT WORTH	6.2	1.0	7.4	1.5	3.0	7.8	1.2	0.5	45.2
DENVER	3.6	0.8	4.5	1.3	4.1	8.4	1.0	0.5	50.6
HOUSTON	5.9	1.1	7.2	1.8	3.4	8.0	1.3	0.7	51.2
LOS ANGELES	16.1	3.4	19.8	5.5	3.5	8.0	3.7	2.0	54.1
SAN FRANCISCO	6.8	1.4	8.3	2.2	3.4	8.1	1.5	0.8	53.8
SEATTLE	4.3	1.4	5.1	2.1	2.7	6.9	0.8	0.7	90.5
AIRCRAFT MECHANICS									
HARTFORD	1.7	0.6	2.2	1.1	4.7	10.5	0.5	0.5	95.7
LOS ANGELES	5.7	1.3	7.1	2.1	3.8	8.8	1.4	0.9	60.0
AUTO MECHANICS&REPAIRERS									
LOS ANGELES	37.7	1.6	44.8	2.3	2.9	6.4	7.1	0.7	9.8
MAINT. MECH&REPAIRERS GEN UTIL									
LOS ANGELES	25.6	2.2	30.1	3.3	2.7	7.0	4.5	1.1	24.4
MACHINISTS									
LOS ANGELES	8.8	1.4	10.5	2.2	2.9	7.8	1.6	0.8	49.6
SHEET-METAL WORKERS&TINSMITHS									
LOS ANGELES	3.9	1.0	4.8	1.7	3.3	8.3	0.9	0.6	73.9
BLUE COLLAR WORKER SUPERVISORS									
ANAHEIM	7.8	1.1	9.4	1.7	3.1	8.0	1.6	0.6	39.8
DALLAS-FORT WORTH	13.2	1.7	15.2	2.5	2.4	7.0	2.0	0.8	41.5
LOS ANGELES	30.5	4.8	36.0	7.4	2.8	7.3	5.5	2.6	46.1
SAN JOSE	7.4	1.3	9.3	2.2	3.8	8.9	1.9	0.9	46.0
INSPECTORS									
ANAHEIM	4.7	1.0	5.7	1.5	3.3	8.0	1.0	0.6	56.4
BRIDGEPORT	4.5	0.9	5.2	1.4	2.7	8.7	0.8	0.6	74.2
DALLAS-FORT WORTH	6.3	1.5	7.4	2.3	2.6	7.5	1.1	0.8	76.1
HARTFORD	4.2	1.1	5.0	1.9	2.8	8.9	0.8	0.7	96.8
LOS ANGELES	17.1	4.2	20.6	6.6	3.2	7.8	3.5	2.4	68.1
SAN JOSE	6.6	1.3	8.4	2.2	3.9	9.0	1.7	0.9	52.4
TESTERS									
LOS ANGELES	3.6	0.9	4.6	1.5	4.1	8.6	1.0	0.6	60.5

TABLE II.10: FORECAST OF EMPLOYMENT OF SELECTED OPERATIVES IN SELECTED METROPOLITAN AREAS (THOUSANDS OF PERSONS EXCEPT AS NOTED)

OCCUPATION/REGION	1981 TOTAL	1981 DEFENSE	1987 TOTAL	1987 DEFENSE	AVG. ANN. % GROWTH TOTAL	AVG. ANN. % GROWTH DEFENSE	NET NEW EMPLOYMENT TOTAL	NET NEW EMPLOYMENT DEFENSE	DEFENSE SHARE OF GROWTH (%)
AIRCRAFT STRUCTURE&SURFACE ASSEMB									
HARTFORD	1.8	0.8	2.3	1.3	4.1	9.4	0.5	0.6	111.3
LOS ANGELES	4.2	1.7	5.3	2.7	3.7	8.1	1.0	1.0	96.7
ELECTRICAL&ELECTRONIC ASSEMBLERS									
ANAHEIM	7.0	1.3	8.6	2.2	3.6	9.0	1.6	0.9	55.1
BOSTON	10.2	1.7	12.2	2.7	3.0	8.4	2.0	1.1	53.3
DALLAS-FORT WORTH	5.6	1.3	7.1	2.1	4.2	9.2	1.5	0.9	56.7
LOS ANGELES	13.2	3.0	16.6	5.0	3.9	8.9	3.4	2.0	57.8
PHOENIX	4.7	0.7	5.9	1.2	3.7	10.6	1.2	0.5	47.1
SAN JOSE	13.6	1.9	16.6	3.4	3.4	10.0	3.1	1.5	48.3
ASSEMBLERS, NEC									
ANAHEIM	15.7	3.2	19.7	5.3	3.8	8.8	3.9	2.1	53.7
BINGHAMTON	6.0	1.2	7.0	1.9	2.7	8.3	1.0	0.7	71.0
BOSTON	24.9	3.7	29.5	5.9	2.8	8.0	4.6	2.2	47.7
BRIDGEPORT	13.4	1.7	15.6	2.8	2.6	8.9	2.2	1.1	49.6
DALLAS-FORT WORTH	17.5	2.8	21.4	4.7	3.4	8.8	3.8	1.9	48.3
DENVER	6.8	1.3	8.5	2.1	3.7	8.3	1.7	0.8	47.1
HARTFORD	8.3	1.3	9.6	2.2	2.6	8.9	1.4	0.9	65.3
LOS ANGELES	47.4	10.4	58.8	17.0	3.7	8.6	11.5	6.6	57.6
PHOENIX	9.0	1.4	11.5	2.5	4.1	10.4	2.5	1.1	45.2
SAN DIEGO	6.6	1.5	8.3	2.4	3.9	8.8	1.7	1.0	56.8
SAN FRANCISCO	8.6	1.0	10.2	1.7	3.0	8.7	1.6	0.7	41.2
SAN JOSE	25.3	5.4	32.6	9.3	4.3	9.6	7.3	3.9	53.8
DRILL PRESS&BORING MACH. OPER.									
LOS ANGELES	5.4	1.0	6.4	1.6	3.0	8.5	1.1	0.6	58.9
GRINDING&ABRADING MACH. OPER.									
LOS ANGELES	5.8	1.1	6.9	1.7	2.8	8.4	1.1	0.7	61.6
LATHE MACHINE OPERATORS, METAL									
LOS ANGELES	7.8	1.4	9.3	2.3	2.9	8.4	1.5	0.9	59.7
MACHINE TOOL OPERATORS, COMB.									
LOS ANGELES	8.0	1.3	9.5	2.1	2.8	8.5	1.4	0.8	56.6
MILLING&PLANING MACHINE OPERATORS									
LOS ANGELES	4.3	1.2	5.3	1.9	3.4	8.2	1.0	0.7	75.4
WELDERS&FLAMECUTTERS									
LOS ANGELES	14.5	2.2	17.6	3.6	3.0	8.5	2.8	1.4	50.6
FILERS, GRINDERS, BUFFERS&CHIPPERS									
LOS ANGELES	5.1	1.1	6.1	1.7	3.0	8.3	1.0	0.6	64.5
OPERATIVES, NEC									
DENVER	48.2	3.5	57.1	5.0	2.9	6.1	8.9	1.5	16.6
ORLANDO	18.1	1.4	21.2	2.2	2.7	7.3	3.1	0.7	23.7
PHOENIX	36.4	2.5	42.9	3.8	2.8	7.3	6.5	1.3	20.0
SAN JOSE	38.0	4.5	45.3	7.1	2.9	8.0	7.2	2.6	36.4

SECTION III: METHODOLOGY

As summarized by the simplified diagram in Figure III.1, the Regional Occupation Planning and Evaluation System is comprised of six major components. Each component performs a specialized role in estimating state- and SMSA-level employment by occupation. The starting point for analysis is the Defense Interface Model in which assumed levels of expenditures for defense and their distributions among 50 budget categories are initially evaluated as to their impacts on industrial production. The outputs of the Defense Interface Model are then used as inputs to DRI's U.S. Macro Model to determine impacts on key macroeconomic indicators, including components of Gross National Product (i.e., personal consumption expenditures, investment, exports and imports, and federal and state and local government purchases), interest rates, prices, wages, and employment. Forecasts from the U.S. Macro Model are used in turn within DRI's Defense Interindustry Forecasting Model to estimate sectoral output and employment. The output and employment forecasts are then disaggregated to the state and SMSA level in a regionalization component, and the employment estimates are distributed among occupations in DRI's national Occupation by Industry Model. The regional estimates of employment are then merged with the occupational employment estimates to arrive at estimates of employment by occupation in each of the 50 states and the District of Columbia, and in each of 70 SMSA's. This section describes each of the components of ropes in further detail, and provides discussions regarding assumptions and data used in the methodology.

The Defense Interface Model

The Defense Interface Model is a staging area for detailed forecasts of the impacts of expenditures for defense on the U.S. economy. A user of the model provides assumptions regarding total expenditures for defense and their distribution among the fifty budget account categories listed in Table III.1. The Interface Model evaluates these inputs using a database containing information on the distribution of expenditures in each budget category among 400 supplying industries comprising the entire economy. The Interface Model uses these data to estimate changes to baseline estimates of industrial production given alternate assumptions with regard

Figure III.1

Simplified Diagram
of the
Regional Occupation Planning and Evaluation System

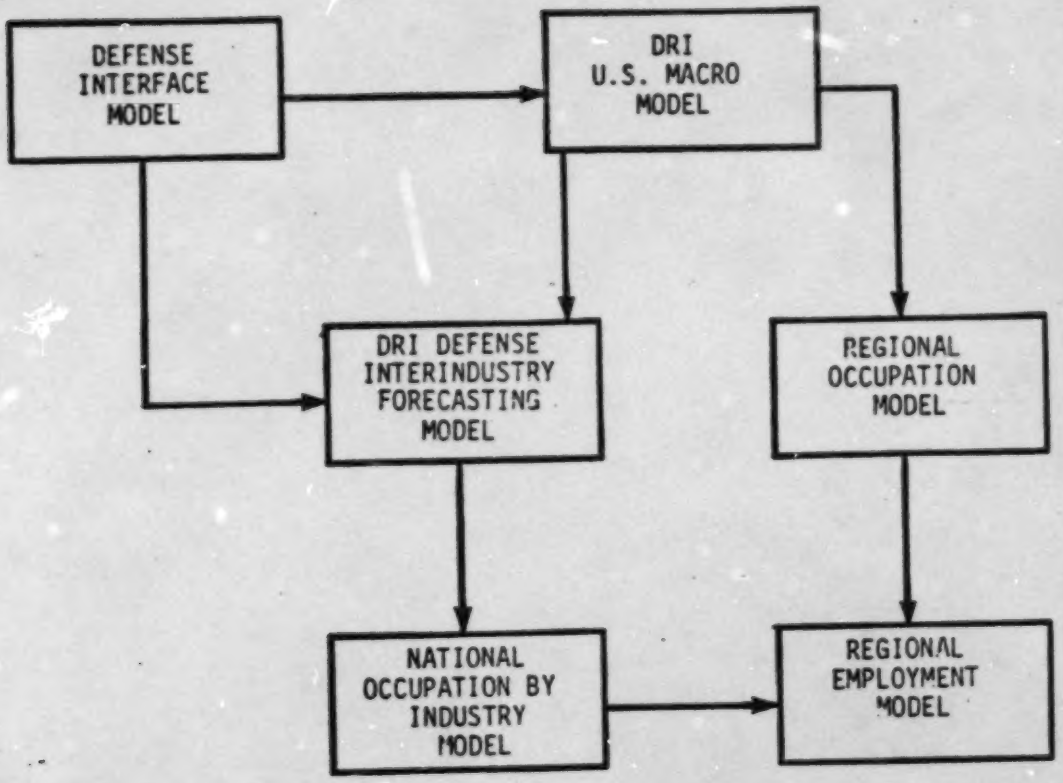


TABLE III.1 DEFENSE EXPENDITURE CATEGORIES

No.	Name
	Military Personnel
1	Army
2	Navy
3	Marine Corps
4	Air Force
5	Army Reserve
6	Navy Reserve
7	Marine Corps Reserve
8	Air Force Reserve
9	Army National Guard
10	Air Force National Guard
11	Retired Pay, Defense
	Operation and Maintenance
12	Army
13	Navy
14	Marine Corps
15	Air Force
16	Defense Agencies
17	Army Reserve
18	Navy Reserve
19	Marine Corps Reserve
20	Air Force Reserve
21	Army National Guard
22	Air National Guard
	Procurement
	Army
23	Aircraft
24	Missiles
25	Weapons and Tracked Vehicles
26	Ammunition
27	Other

No.	Name
	Procurement (cont'd)
	Navy
28	Aircraft
29	Weapons
30	Ships and Conversions
31	Other
32	Marine Corps
	Air Force
33	Aircraft
34	Missiles
35	Other
36	Defense Agencies
	Research, Development, Test and Evaluation
37	Army
38	Navy
39	Air Force
40	Defense Agencies
	Military Construction
41	Army
42	Navy
43	Air Force
44	Defense Agencies
45	Army National Guard
46	Air National Guard
47	Army Reserve
48	Navy Reserve
49	Air Force Reserve
50	Family Housing

to expenditures for defense. The Interface Model also provides forecasts of final demands for goods and services necessary to support defense initiatives.

The DRI U.S. Macro Model

The DRI U.S. Macro Model uses inputs from the Interface Model and other assumptions to generate unique forecasts of economic activity at an aggregate national level. This model is the core component of all DRI services, providing the linkage between total U.S. economic activity, key U.S. industries, and major international economies. Using the Model, DRI economists prepare short-term and long-term forecasts of the major dimensions of the U.S. economy on a monthly basis. These forecasts project disaggregations of consumer spending, business investment in plant, equipment, and inventories, construction activity, government receipts and expenditures, wages, interest rates, major price indexes, and the composition of exports and imports. A complete set of financial projections, interest rates, monetary aggregates,household and corporate flows of funds, and mortgage activity is provided. An outline of the 1000-variable Model by major sector follows.

Inflation Rates: Measures of the three components of consumer price inflation are included in the Model. The "core" rate of inflation is defined as that part of inflation which can be traced directly or indirectly to expectations determined by past experience. The "shock" rate of inflation is attributable to shocks such as energy and food price hikes. The "demand" rate of inflation is attributable to excess aggregate demand.

Consumption: The DRI model disaggregates consumer spending into 14 categories, relating them to disposable income, relative prices, demography, physical stocks, risk and sentiment variables, and household financial assets and debt. The traditional role of current-period income has thus been deemphasized while the impact of the financial sector has been strengthened.

Housing: The housing sector explicitly models the supply of three types of housing (single-family and multi-family starts, and mobile home shipments) relying heavily

on financial and profitability measures. Housing demand is modeled from demography, income, consumer confidence and relative cost. Supply and demand are brought together in measures of disequilibrium, including vacancy rates and the inventory of houses for sale.

Business Investment: The investment equations are based on the Jorgenson neoclassical approach modified to include (1) the impact of pollution abatement requirements, (2) an accelerator term capturing the greater need to replace capital given higher utilization rates, and (3) a sales disappointment term depressing investment. A measure of the cost of capital which reflects the actual mix of debt and equity financing is used. Corporate debt service also enters separately, further strengthening the impact of financial conditions. Investment equations for 22 separate industries use a similar neoclassical approach.

Inventories: The standard relationship between sales and the desired stock of inventories forms the basis of the inventory equation. Deviation of sales from projected sales expectations captures unintended accumulation. The cyclical behavior of inventories has been heightened through the use of both capacity utilization and vendor performance, creating a very sensitive production-inventory-price loop.

Federal Government: The Federal Government sector of the DRI model is designed to capture the broad detail of Federal program activity and the automatic-stabilizing features of the defense purchases, nondefense purchases, grant-in-aid, transfers to foreigners, wage accruals less disbursements, and subsidies less surplus of government enterprises. The remaining elements of the budget which respond directly to the level of economic activity are modeled endogenously. These include: transfers to persons, interest payments, and all receipt categories, such as personal tax and nontax payments, corporate tax accruals, indirect business taxes, and social insurance contributions. A number of fiscal policy simulation levers can be used in the Model to ascertain the impact of federal government policy upon the major dimensions of the economy.

State and Local Government: The formulation of the behavioral equations in the state and local sector reflects the high degree of interdependence of revenues and expenditures. In the DRI Model, the state and local sector is treated as an endogenous behavioral component of the economy. Thus, local fiscal behavior is

endogenously determined from the sector's revenue needs, making outlays dependent on the financial position of state and local governments, their normal growth of revenues, and demographic factors.

Foreign Trade: The foreign trade sector includes disaggregated equations for six categories of commodities and services for both exports and imports. The equations rely primarily on relative prices and activity variables. The foreign activity measures and the exchange rate are exogenous, although the level of U.S. activity does affect the foreign economies through the use of reflection ratios.

Wages and Prices: The fundamental wage equation captures the impact of both inflation and labor market conditions. A total of 19 wholesale prices and 23 price deflators are modeled using a stage-of-processing approach, with the equations using constrained weights on input-cost terms from the input-output matrix. Labor and excise tax costs as well as demand measures are also added to the equations.

Income: Profits are forecast with a behavioral equation relying on output, price-cost spreads, and capacity utilization. Personal income depends on the overall level of economic activity determined on the expenditure side.

Unemployment: The aggregate unemployment rate is forecast using a traditional Okun's Law approach. A set of social indicator equations also calculates the detailed structure of unemployment by age, sex, and race.

Interest Rates: The model includes forecasts for 25 major interest rates through a segmented market determination of the demand-supply behavior as it pertains to each market. Long-term rates are determined separately from short-term rates, relying primarily on inflation expectations and market-specific demand and supply of liquidity. The short-term rates are also determined from the interaction of the supply of liquidity, in this case largely determined by monetary policy as well as portfolio adjustments of lending institutions, and by the market-specific liquidity demands.

Flow of Funds: The Model includes equations for the non-financial corporate balance sheet items, broken down into uses and sources of funds, details of household financial assets and liabilities, and a highly disaggregated representation

of mortgage market. Inclusion of this detail allows more accurate forecasting of the GNP expenditures totals, because explicit balance sheet constraints are available.

Industry Production: The set of 56 internally simultaneous industry production equations rely on an input-output approach with the trend and cycle influences on the level of production corresponding to a given level of output explicitly modeled. Systematic influences such as detailed changes in the mix of final demands are also included. Estimates of the impacts of purchases for defense are explicitly captured through links to the Defense Interface Model.

Industry Employment: The production equations are supplemented with a set of 30 industry employment equations embodying a production function, relying on the appropriate output measure and a time trend as a proxy for the long-run trend in productivity. The stickiness of employment with respect to production is captured through a partial adjustment coefficient attached to the prior level of employment.

The major innovations of the Model are described below.

(1) Modeling Sectoral Flow of Funds, Balance Sheets, and Financially-Real Interactions. Decisions concerning uses and sources of funds are explicitly modeled in a simultaneous framework; the evolution of the corporate balance sheet is an endogenous result. Outlays for physical or financial assets (uses of funds) are accompanied by the requisite financing. Sources of financing include cash flow, proceeds from the sale of financial assets, accumulation of short- and long-term debt, and new equity issues. The need for external financing is the gap between internal sources and projected uses of funds. The profile of financing that closes this gap depends upon alternative costs of the various financial instruments and the existing balance sheet position. Given the determination of the various sources and uses of funds for each period, the resulting balance sheet is calculated by a set of identities. Hence, the flows of funds behavior determines the nature and composition of the corporate balance sheet.

The balance sheet conditions produced by the corporate flow of funds model become significant inputs for the business spending equations. Some of the traditional balance sheet liquidity ratios and the composite interest burden relative to cash flow are variables which help to explain business outlays on fixed investment,

inventories, and employment. These variables provide an important new set of links from financial conditions to real spending, and raise the power of monetary policy. These liquidity effects substantially enhance the impact of monetary policy on business spending beyond those identified through interest rate and cost of capital measures. This innovation increases the Model's cyclical representation of the economy.

(2) Stage-of-Processing Approach to Prices. This approach has enabled development of econometric models which trace inflationary impulses from the raw materials stage through semi-finished, finished wholesale, and retail prices. At each stage of processing, the prices from the previous stage provide an estimate of material costs. Labor costs and demand measures are added in equations for the price index of the particular stage. Among the raw material prices in the sector are the prices of world oil, lumber, and the composite wholesale price index for agricultural commodities. The prices of semi-finished goods include such processed materials as metals, paper, and the composite price of energy, and fabricated metals. Finished goods prices at wholesale include machinery, transportation equipment, and processed foods. At the retail stage, the model includes the Consumer Price Indexes for food, nonfood commodities, and services. GNP deflators in turn are calculated principally from the particular wholesale and consumer prices, following the technique used by the Bureau of Economic Analysis. This approach permits the model to reflect the impact of alternative OPEC pricing strategies or varying agricultural prices.

(3) More Elaborate Modeling of Supply Conditions and Their Impacts on Prices and Inventory Behavior. Econometric models represent market behavior rather than government controls of physical quantities or price ceilings. Thus, modeling of supply conditions has to be carried out in the context of market behavior of prices and quantities. The DRI Model represents such behavior in several quite elaborate ways. First, the Model calculates the utilization rates of manufacturing as a whole, of the materials industries, and of several individual industries. Capacities are estimated from investment outlays for 2-digit level industries. Production is estimated from the flexible coefficient input-output block in the Model. These utilization rates are important inputs to the stage-of-processing equations for wholesale prices. Utilization rates also play a role in profit and productivity equations.

A second important measure in the DRI Model increases the sensitivity of industrial prices to demand, particularly to excess demand. This measure, "vendor performance," is a widely-reported response in the monthly Survey of Purchasing Executives, who are asked whether they are experiencing slower deliveries. Vendor performance has long been recognized as a leading business cycle indicator. Used in wholesale price equations, it greatly increases explanatory power.

Third, the Model calculates aggregate supply, which affects the unemployment rate, wages and prices. Finally, when a particular commodity is in an extraordinary supply situation not created by market forces and therefore not reflected in price behavior (e.g. strike disruptions or OPEC embargoes) special model solutions can be developed with demands held back by the particular supply constraint.

(4) Inventory Behavior and the Inventory-Production-Price-Loop. The DRI Model contains a significant innovation in its inventory equation. The utilization rate of industry was shown to affect inventory behavior. When utilization is high, delivery periods lengthen, and the optimal inventory stock is therefore larger for a given level of sales.

However, the utilization rates are sluggish and imprecise measures. Consequently, it has proved necessary to develop an approach to inventory behavior which corresponds more closely to the highly unstable behavior which has been observed in the postwar years. This new approach is based on the use of the vendor performance measure that was also found to be powerful in price equations. When vendor performance deteriorates, the response of purchasing executives is to become more aggressive, and to seek to hold larger inventories.

(5) Modeling Expectations and Error. The experience of the last few years has shown that businesses do make mistakes on occasion by acting on false expectations about the future paths of their markets, prices, and costs. The econometric models of the 1960's and early 1970's emphasized adaptive expectations and sluggishly acting distributed lag formulations which typically understated the important role of error in the business cycle. The DRI Model marks a major research effort to develop spending equations with sufficiently elaborate expectations mechanisms to calculate the deviations between business expectations and actual results.

(6) The Industry Production Equations. These equations embody elements of the input-output structure within production. Previously, econometric models used "bridge" equations that were driven entirely by the final demands, reflecting inter-industry relations only through the matrix of input-output "bridge" coefficients that

derive production from final demands. The new structure explicitly shows how finished good production determines materials output, thereby allowing inventory and other changes in a "downstream" industry to impart a greater sensitivity to materials industry activity.

(7) The Investment Equations. These equations while still based on the Jorgenson neoclassical approach, have reintroduced utilization rates as proxies of future business-output expectations. Also, a more precise measure for the cost of capital is now employed, reflecting the actual mix of financing and the cost of equity capital. This modification strengthens the balance sheet effects.

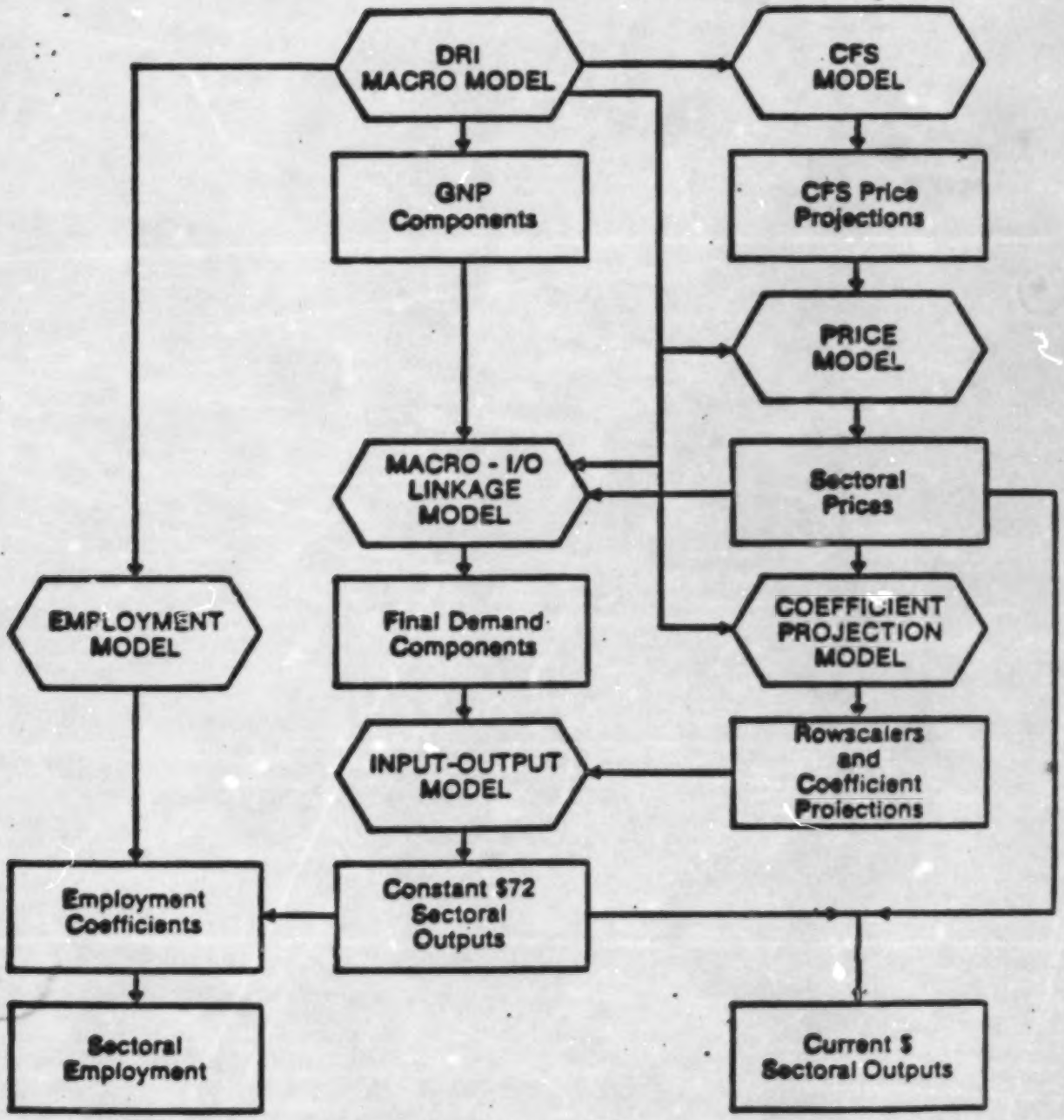
(8) A Disaggregated Foreign Trade Sector. The Model now includes a detailed structure of U.S. foreign trade. The equations follow economic theory closely, relying on relative prices, relative activity levels, and a few commodity-specific variables. The activity levels of the foreign trading partners are modeled through their production indexes. In forecasting, the DRI U.S. Model uses the forecasts developed by the DRI International Group. However, to make the simulation properties of the Model more realistic, reflection ratios are used for our trading partners. The U.S. economy is so large that one must calculate its impact on its partners, and the reflection of their changed situation back on U.S. exports, imports, and activity.

The Defense Interindustry Model

Outputs of the DRI macro model and the Defense Interface Model are used to drive DRI's Defense Interindustry Forecasting System which includes a large scale (403 sector) input-output forecasting model. This model provides detailed estimates of the flows of goods and services between industries and to final consumers. The model was developed using data on the interindustry structure of the U.S. economy, published by the Department of Commerce, Bureau of Economic Analysis, and updated by DRI using state-of-the-art techniques. The extensive detail on the distribution of defense expenditures is explicitly included in the model's framework.

The structure of this key component of ROPES is demonstrated by the simplified flow diagram in Figure III.2. As can be seen in the diagram, the input-output model is initially driven by the DRI Macro Model, which provides estimates of GNP disaggregated into 58 components. These components provide some detail on

Figure III.2: Structure of the Interindustry Model



personal consumption expenditures; private investment in plant and equipment; federal, state and local government purchases of goods and services; exports and imports. The DRI Macro Model also drives DRI's Cost Forecasting Service (CFS) Model.

The CFS Model provides detailed price and wage forecasts based on analyses of industrial supply and demand. Supply is examined according to stages-of-processing. That is, each commodity price is analyzed in terms of the labor, material and energy mix specific to its production process. Market conditions and external events are also included in the analysis. Demand analysis is based on a delineation of end-use markets for each commodity, as well as identification of the variable relationships between market strength and price change. Statistical methods are used to identify and weight the most significant external influences on price and to represent the timing of supply and demand influences on price behavior. The model provides forecasts for over 250 producer price indexes; hourly earnings of construction workers and production workers in over 40 major SIC industries; facility cost indexes; transportation cost indexes; and selected Consumer Price Indexes.

The Price Model translates forecasts by the CFS Model into estimates by detailed product category, corresponding to the 403 industry breakdown. Generally, the equations in the Price Model use an average of downstream prices for materials combined with labor cost forecasts from the CFS Model, weighted using the input structures of individual industries. These sectoral prices are used in the interindustry framework to enhance estimates of final demand (i.e., the GNP components) from the Macro Model.

Annual forecasts for 160 final demand categories are projected in the Macro-I/O linkage model. This part of the Interindustry Model is driven by the 58 GNP components from the Macro Model, as well as 21 additional variables from the Macro Model and several price variables from the Sectoral Price Model. The final demand components include 14 personal consumption categories, 14 construction categories, 71 plant and equipment investment categories, 10 government purchase categories, 29 export categories, 26 import categories, and 1 inventory change category. Estimates for 17 of these categories come directly from the Macro Model; the remaining series are estimated as shares of an appropriate GNP

component using key mix, price, trend and cycle variables. Defense final demand is further disaggregated into the 50 categories listed in Table III.1, above.

Sector price forecasts and macro variables are also used to drive the interindustry coefficient projection model. The purpose of this model is to estimate changes in the structure of interindustry relationships in response to changes in prices, technology, and taste. The interindustry structure is represented in the model by interindsutry sales coefficients. In those sectors of the economy where changes in the structure take place rather slowly, fixed 1978 coefficients are used over the forecast horizon. In those sectors where change is known to be rapid, however, the coefficients are projected forward over time.

Where data is available from DRI industry models or other sources on anticipated future changes in end uses of a specific commodity, such projections are directly incorporated into the model. For example, the DRI Energy Service forecasts detailed information on energy use by broad sectors. The energy coefficients in the interindustry model are projected forward in a consistent manner using this information. Similarly, the DRI Steel Service forecast of changes in end uses of steel by consuming sectors are directly translated into projections of steel coefficients in the interindustry model.

For those sectors where structural change is expected to be rapid, but where such detailed information is unavailable, coefficients along an entire row will be projected by a rowscaling method. Rowscalers are derived by taking the ratio of actual sectoral output to that generated by multiplying base year 1978 coefficients by known sectoral output levels. If this process is repeated for each year in which sectoral output levels are known, a time series of rowscalers can then be created. This time series indicates whether a specific commodity is being used more or less intensively as an input by all other sectors in the economy over time. By definition, since the base year is 1978, the rowscalers have a value of 1.0 in that year. Thus, if the rowscaler value for electronic components is .75 in 1972 for example, it implies that on the average the use of electronic components as inputs per unit of output by all sectors in the economy has grown by about 30% between 1972 and 1978.

A set of rowscalers for 40 sectors was derived for the period 1963 to 1978. For those sectors where the values of the rowscalers vary closely around 1.0 over the

interval, it can be deduced that change in structure occurs slowly so that coefficients may be kept at their fixed 1978 values over the forecast horizon. For those sectors whose rowscalers show significant growth or decline over time, coefficients can be expected to show continuing change in the future. To capture these changes, a set of rowscaler equations was estimated. The historical rowscalers were regressed against relative prices, as well as cyclical and trend variables from the DRI Macro Model. Given price projections from the Interindustry Price Model and forecasts of the relevant macro model variables, the Rowscaler Model is solved to yield the adjustment factors for technical coefficients along a given row. These rowscaler projections are then incorporated into the output equations of the model in the forecast mode.

Although a rowscaler for a specific sector may have shown rapid growth or decline in the past, this rate of growth may not necessarily continue in the future. For example, historically the output of synthetic fibers has been growing at a rapid pace, while the cotton sector has been declining. Due to factors such as market penetration, changes in relative prices, and the emergence of fabrics which are a mix of cotton and synthetic fibers, the historical pattern no longer holds. The projections of rowscalers into the future must, therefore, take into account those factors which may dampen or even reverse the historical trend. Wherever available, such information is utilized in the rowscaler forecasts.

The heart of DIFS is the Input-Output Model. This component combines projections of final demands and rowscalers with detailed estimates of the structure of interindustry relationships to estimate total production (output) by each of 403 industries. The 160 final demand components and 50 defense final demands are first disaggregated to the 403 sector level using a matrix of bridge coefficients. These coefficients serve to distribute total expenditures in a given final demand category to each industry that supplies goods and services to that final demand category. Once these final demands at the sectoral level are established, the input output model estimates total production by each of the 400 industries simultaneously, as a function of the sales by each industry to all other industries (using the interindustry sales coefficients adjusted by the rowscalers from the coefficient projection model) plus each industry's sales to final demand. Hence, the input-output model accounts for both the sales of finished goods to final consumers, and the sales of raw

materials and semi-finished goods to industries which in turn produce finished goods for sale to final consumers.

Estimates by the Input-Output Model are expressed in constant, 1972 dollars. These estimates are translated into current dollar estimates using price projections by the Price Model. The constant dollar estimates are also used as input to the employment model.

The Employment Model includes a labor demand and supply function for each of the 403 industries. These are used to forecast sectoral employment. In general, the equations of the Employment Model include sectoral real wages (sector nominal wage divided by sector output price), a measure of capital stock (or capacity utilization), full-employment output (used as a proxy for economy-wide changes in technology), and a cyclical variable, such as the ratio of real GNP to its level in 1972. The Employment Model takes into account changes in productivity at the individual industry level.

In summary, the Interindustry Model is actually a system of models that are solved in succession to yield 403 sectoral outputs in constant and current dollars, and 403 employment levels. The solution procedure involves the following steps:

- Develop defense spending assumptions in the Defense Interface Model.
- Solve the DRI Macro Model for a given scenario.
- Generate a companion Cost Forecasting Model solution.
- Solve the Interindustry Price Model to generate 403 sectoral prices.
- Solve the macro-I/O linkage model to generate 160 final demand components and 50 defense final demand components.
- Solve the coefficient projection model to generate changes in technical coefficents.
- Solve the final demand equations to generate 403 sector final demand levels.
- Solve the output equations to yeild 403 sectoral output levels (constant dollars).
- Solve for output for defense.
- Multiply sectoral prices by constant dollar output levels to calculate nominal output levels.

- o Solve the Employment Model to generate a set of sectoral employment levels.
- o Solve for employment for defense.

The National Occupation by Industry Model

The national Occupation by Industry Model uses employment forecasts from DRI's Defense Interindustry Model and the Bureau of Labor Statistics' Occupational Employment Statistics (OES) survey data to arrive at unique forecasts of occupational employment levels nationally. The OES data have been aggregated by DRI to reflect the employment of 163 occupations in 82 industries. The latter are aggregations of the 400 industries in the Defense Interindustry Forecasting Model. The national Occupation by Industry Model generates forecasts by moving base year (1980) estimates of sectoral employment of wage and salary workers forward in time according to the sectoral employment forecasts from the Interindustry Model. Resulting total employment estimates for each industry are then distributed among occupations in each industry using shares implied by the OES data. The results are then aggregated across the industries to arrive at estimates of total employment of wage and salary earners by occupation. Estimates of total occupational employment are obtained by scaling estimates of total employment of wage and salary earners according to the ratios of wage and salary earners to total workers by occupation in 1980. That is, the 1980 ratios are kept constant over time.

Regionalization

Estimates of employment by occupation in each state and in each of 70 SMSA's are obtained by combining forecasts of national employment by occupation from the National Occupation by Industry Model, forecasts of national outputs and employment from the Defense Interindustry Model, and state projections of employment by industry from DRI's Regional Information Service (RIS). Estimates of direct and indirect output and employment for defense are explicitly considered within the regionalization methodology.

The following categories of economic activity and their distributions among 82 supplying industries are addressed:

Total Production*
- Nondefense Production
- Production for Defense
  - Direct Purchases for Defense
    - Military Personnel
    - Operations & Maintenance
    - Procurement*
      - Aircraft
      - Missiles
      - Weapons and Tracked Vehicles
      - Ships and Conversions
      - Other
    - Research, Development, Test and Evaluation*
    - Military Construction
  - Indirect Requirements for Defense*

Each category of direct purchases for defense is regionalized using slightly different approaches as described below. However, estimates of indirect requirements for defense, nondefense production and total production are obtained using a "shift-share" methodology. This methodology works as follows:

Base year (1979) estimates of total employment by each industry in each state and SMSA were obtained from Department of Commerce County Business Patterns data. These estimates were converted into shares of national employment by each industry to serve as a starting point for sharing out national estimates of employment and production. Since the 1979 shares are by no means constant over time (viz. out migration of industry from the "frost belt" to the "sun belt"), the shares are shifted over time using state-level forecasts of employment by each of 27 industries from DRI's Regional Information Service (RIS) model.

The RIS model provides estimates of state level employment by 2-digit SIC using econometric equations that take into account economic factors specific to each state. The 1979 state-level employment shares for each of 82 industries are shifted

*These categories are regionalized by SMSA as well as by state.

on the basis of the change in the state-level shares of each industry's 2-digit "parent" industry as implied by the RIS forecasts.

Since the resulting estimates at the state-level, when summed across states to the national level do not equal the starting values of national employment and production, the initial state level estimates (and those of the SMSA's included within each state) are scaled by the ratios of the starting national estimates to the corresponding sums of the initial state level estimates.

Estimates of total production and employment are regionalized first, using the shift-share methodology. The resulting estimates then serve as controls for the component parts of industry totals (i.e., nondefense production, total requirements for defense, and direct and indirect purchases for defense). For example, the County Business Patterns data show then 17.7 percent of total 1979 employment by the Radio and TV communication equipment industry was employed in the state of California. The RIS estimates suggest that this share shifted 5.8 percent between 1979 and 1981, and the DIFS Interindustry Model estimates national production by this industry at $28.7 billion (in 1972 dollars). Hence, the initial 1981 estimate for California was calculated as $28.7 x .177 x 1.058=$5.37 billion. This estimate was revised downward to $5.3 billion in the scaling procedure.

The shift-share algorithm is also used to regionalize nondefense production. The DIFS model provides estimates of nondefense production nationally (i.e., total production minus total requirements for defense), and the County Business Patterns and RIS data serve to distribute these estimates to the state and SMSA level. Similarly, DIFS estimates of indirect requirements for defense nationally (i.e., total requirements for defense minus direct purchases for defense) are initially obtained using the shift-share algorithm and then scaled to conform with national-control totals.

The components of direct purchases for defense are regionalized as follows:

Military Personnel

Over 85 percent of expenditures from military personnel accounts are for wages and salaries paid to uniformed personnel. State-level disaggregation of national estimates of compensation is achieved using data provided by the Office of the

Secretary of Defense. OSD provided estimates of miitary and civilian pay by state. The most current estimates available are for 1981. The 1981 military pay estimates were converted into state shares of national military pay for use in estimating future state level military pay. The residual 15 percent of expenditures from military personnel are for first issue uniforms, transportation of persons and things, and miscellaneous services. These estimates are regionalized using the shift-share methodology. For example, total expenditures for transportation and warehousing from military personnel accounts in 1981 is estimated by DIFS at $972 million (in 1972 dollars). The County Business Patterns data shows that 11.46 percent of the employment in this industry was located in California in 1979. The RIS model projects a shift of 0.8 percent in this share between 1979 and 1981. Therefore, California's share of expenditures for transportation and warehousing from military personnel acconts in 1981 is estimated as $972 x .1455 x 1.008 = $112 million. California's share of military pay in 1981 is given as 15.7 percent, and, total military pay in 1982 is estimated by DIFS at $14.9 billion (in 1972 dollars). Therefore, military pay in California is estimated as $14.9 x .157 = $2.4 billion.

Retired Pay

Retired pay is regionalized in the same way as military personnel compensation. That is, state-level estimates of retired pay in 1981 were converted into shares of national retired pay for use in forecasting future state-level retired pay. California's share of retired pay measured 15 percent in 1981. Retired pay nationally was $5.7 Billion. Therefore, 1981 retired pay in California is estimated as $5.7 x .15 = $.86 Billion.

Operations and Maintenance

The Department of Defense, Washington Headquarters Services publishes "Prime Contract Awards by Region and State," which provides estimates of prime contract awards in each of 25 categories, including subsistence, services, petroleum, other fuels, production equipment, etc. these estimates were used to develop state-level shares of operations and maintenance expenditures by industry in 1981. These shares are used to estimate future operations and maintenance expenditures by industry and state.

Operation and maintenance accounts provide for wages and salaries of civilian personnel. These expenditures are regionalized using 1981 state shares of civilian pay.

An estimated $524 million from O&M accounts was spent on refined petroleum products in 1981. The state of California received 12.9 percent of prime contract awards for petroleum products during 1981. Therefore, California's share of O&M expenditures for petroleum refining is estimated as $524 x .129 = $68 Million. California's civilian defense personnel received 14.9 percent of civilian pay in 1981. Total civilian pay from O&M accounts amounted to $8.34 billion. Therefore California received $8.34 x .149=$1.24 Billion.

Procurement

State level estimates of direct purchases from procurement accounts were obtained from detailed prime contract awards data compiled by DMS. These data provide state (and sub-state) level estimates of prime contract awards for procurement items, by contract value and by Federal Stock Codes. A concordance between Federal Stock Codes and Standard Industrial Classification Codes was developed by DRI to facilitate the linkage between direct purchases and the SIC-based DIFS framework. State level shares were calculated to be a constant equal to the average of awards to an industrial sector by state of SMSA for the period 1979-81 divided by national awards to that industry. As in the case of operations and maintenance shares, the procurement shares were held constant over time for the purpose of initial forecasts, but could be modified to conduct parametric analyses. Some compensation of civilian personnel comes from procurement accounts. State-level estimates for this category of expenditure are obtained using the same process used for compensation from O&M accounts.

Nationally, the Department of Defense spent $3.6 billion from procurement accounts on aircraft and parts. The DMS data for 1979, 1980 and 1981 shows that California received about 8.2 percent of prime contract awards for aircraft and parts. Initial estimates of aircraft and parts purchased from California in 1981 totalled $3.6 x .082 = $0.296 Billion. These estimates were subsequently revised upward to $0.371 billion as a consequence of the cycling procedure described earlier. Nationally, $280 million in civilian pay came from procurement accounts in 1981. Recalling California's civilian pay share at 14.9 percent, civilian personnel in California received $280 x .149 = $41.7 Billion.

Research, Development, Test, and Evaluation

The DMS data also provides estimates of the total value of prime contracts for research and development by state and sub state. These data are used to distribute the national estimates of defense expenditures for Research, Development, Test and Evaluation (RDT&E). Industrial detail is obtained by combining national estimates of the distribution of RDT&E by industry with employment shares for the relevant industries in each state. That is, the RDT&E expenditures are regionalized with regard to the existence of R&D supplying industries in each state. If the County Business Patterns data indicates no employment in a given industry in a given state, then no RDT&E expenditures are distributed to that industry in that state even if the industry supports RDT&E nationally. Compensation of civilian personnel from RDT&E accounts is regionalized the same way as compensation of civilian personnel from O&M and procurement.

The DMS data shows that California received 28.6 percent of prime contract awards for research, development, test and evaluation over the period 1979 to 1981. The aircraft and parts industry received $346 million in RDT&E funding in 1981. An initial estimte of 1987 aircraft RDT&E funding in California was found as $346 x .286 = $99 Million. This estimate was revised upward to $12.7 million as a result of the scaling procedure. Total civilian pay from RDT&E accounts was $631 million in 1981. California received 14.9 percent, or $94 million.

Military Construction

Data on prime contract awards for military constructin are used to distribute this final category of direct defense expenditure. These data were provided by the Department of Defense, Washington Headquartrs Service. Industry detail by state is developed using the same approach used to distribute RDT&E. Compensation of civilian personnel from military construction accounts is regionalized the same way as compensation of civilian personnel from other accounts. Total direct requirements by state are estimated by adding up estimates for each of the 6 components of direct purchases.

Prime contract awards data from the Department of Defense show that California received 13.8 percent of all prime contracts for military construction in 1981. The construction industry received $965 billion from military construction accounts. California received $965 x .138 =$133 billion. Of the $187 million received by civilian personnel from military construction accounts, personnel in California received $287 x .149 = $43 Million.

The state and SMSA estimates of employment by industry and each category above are merged with national estimates of occupational employment by industry to arrive at regional estimates of occupational employment. That is, it is assumed that the distribution of occupational employment within a given industry and state or SMSA is the same as the distribution of occupational employment within the industry nationally. This limitation will be corrected with future development of ROPES during which occupational employment data specific to each state will be used. Total employment by occupation in each region is estimated by summing across industries within the region and then scaling using national wage and salary workers to total ratios as is done at the national level.

Section IV: Sample Forecast Details

- o U.S. Totals
- o California
- o Los Angeles

REGIONAL OCCUPATION PLANNING AND EVALUATION SYSTEM
FORECAST OF NATIONAL EMPLOYMENT BY OCCUPATION
(THOUSANDS OF PERSONS EXCEPT AS NOTED)

OCCUPATION	1981		1987		AVG. ANN. % GROWTH	
	DEFENSE	TOTAL	DEFENSE	TOTAL	DEFENSE	TOTAL
TOTAL, ALL OCCUPATIONS	3,821.7	84,960.9	5,302.1	97,165.2	5.6	1.3
ENGINEERS	124.7	1,032.9	210.3	1,223.1	9.1	2.9
AERONAUTRONAUTIC ENGINEERS	25.8	61.0	48.6	89.5	11.2	6.6
CHEMICAL ENGINEERS	3.0	54.3	4.5	59.3	7.0	1.5
CIVIL ENGINEERS	3.7	97.9	5.2	112.0	5.8	2.3
ELECTRICAL ENGINEERS	37.4	304.7	65.1	340.1	9.7	3.8
INDUSTRIAL ENGINEERS	9.7	111.5	15.7	125.1	8.3	1.9
MECHANICAL ENGINEERS	17.0	202.4	29.2	232.9	8.8	2.4
METALLURGICAL ENGINEERS	1.4	14.7	2.5	17.1	9.8	2.6
MINING ENGINEERS	0.2	5.2	0.4	6.1	7.8	2.8
PETROLEUM ENGINEERS	1.0	19.2	1.5	22.7	7.6	2.8
ALL OTHER ENGINEERS	24.9	161.9	37.7	174.2	7.1	1.6
SCIENTISTS NEC	11.3	218.2	16.3	241.0	6.3	1.7
CHEMISTS	3.6	79.9	5.4	86.7	6.2	1.4
PHYSICISTS	1.1	13.4	1.7	14.6	7.4	1.5
BIOLOGICAL&MEDICAL SCIENTISTS	1.1	32.9	1.6	36.4	6.2	1.7
LIFE&PHYSICAL SCIENTISTS NEC	2.7	55.3	3.9	61.3	6.3	1.7
MATHEMATICIANS&STATISTICIANS	2.3	27.0	3.4	30.0	6.9	1.8
MATHEMATICAL SPECIALISTS NEC	0.4	8.8	0.6	12.0	8.5	3.4
ENGINEERING&SCIENCE TECHNICIANS	78.4	1,050.0	117.4	1,201.7	7.0	2.3
CIVIL ENGINEERING TECHNICIANS	0.7	25.8	0.9	29.8	3.7	2.5
DRAFTERS	10.7	303.9	25.9	340.0	7.5	2.2
ELECTRICAL&ELECTRONIC TECHNICIANS	28.5	337.9	47.2	401.6	8.8	2.9
INDUSTRIAL ENGINEERING TECHNICIANS	2.1	25.7	3.6	28.4	7.9	1.7
MECHANICAL ENGINEERING TECHNICIANS	7.5	48.5	12.3	56.0	8.6	2.8
ENGINEERING&SCIENCE TECH NEC	18.8	308.6	29.0	340.8	8.8	1.6
HEALTH WORKERS	96.2	3,185.1	124.3	3,760.5	8.8	2.8
DENTISTS	5.1	172.1	6.7	211.5	8.8	3.5
PROFESSIONAL NURSES	31.8	1,038.9	42.9	1,310.7	5.8	3.9
PHYSICIANS, MEDICAL&OSTEOPATHIC	13.8	488.8	17.5	542.1	4.6	3.2
ALL OTHER HEALTH PROFESSIONALS	6.8	217.6	8.1	240.0	8.1	1.6
OTHER HEALTH WORKERS	80.8	1,307.7	89.0	1,456.2	3.5	1.8
TECHNICIANS NEC	12.8	200.7	18.0	218.5	5.9	1.3
AIRPLANE PILOTS&FLIGHT ENGINEERS	5.8	79.6	7.8	86.8	5.8	1.8
ATC TRAFFIC CONTROLLERS	0.0	0.0	0.0	0.0	--	--
RADIO OPERATORS	0.1	2.2	0.1	2.8	8.2	1.3
TECHNICAL ASSISTANTS, LIBRARY	0.8	31.9	1.0	32.5	1.4	0.3
TOOL PROGRAMMERS,NUMERICAL CONTROL	1.2	10.5	1.9	11.4	7.8	1.3
ALL OTHER TECHNICIANS NEC	5.0	76.8	7.3	83.5	8.8	1.5
COMPUTER SPECIALISTS	22.2	393.9	39.9	515.8	10.2	4.6
COMPUTER PROGRAMMERS	11.3	217.0	19.0	271.0	9.0	3.8
COMPUTER SYSTEMS ANALYSTS	10.9	176.8	20.9	244.8	11.5	5.5
SOCIAL SCIENT,&OTHER PROFESSIONALS	312.8	8,415.8	381.1	8,356.0	3.3	-0.1
ECONOMISTS	0.9	15.7	1.8	18.8	8.1	2.7
SOCIAL SCIENTISTS NEC	8.3	113.2	5.8	128.5	5.1	2.1
TEACHERS	113.3	3,805.6	105.2	3,251.7	-1.2	-2.6
COLLEGE&UNIVERSITY TEACHERS	13.8	853.1	13.8	821.6	0.1	-1.2

REGIONAL OCCUPATION PLANNING AND EVALUATION SYST...1
FORECAST OF NATIONAL EMPLOYMENT BY OCCUPATION
(THOUSANDS OF PERSONS EXCEPT AS NOTED)

OCCUPATION	1981		1987		AVG. ANN. % GROWTH	
	DEFENSE	TOTAL	DEFENSE	TOTAL	DEFENSE	TOTAL
ELEM&SECOND SCHOOL TEACHERS	71.8	2,432.3	58.5	1,880.0	-3.3	-4.5
VOCATIONAL EDUCATION TEACHERS	0.9	27.7	1.2	31.6	3.9	2.2
ALL OTHER TEACHERS	27.3	892.5	32.1	958.6	2.7	1.2
WRITERS, ARTISTS & ENTERTAINERS	42.4	926.0	50.6	992.3	3.5	1.2
PROFESSIONAL&TECH WORKERS NEC	151.8	3,555.3	210.1	3,965.0	5.6	1.8
BUSINESS PROFESSIONAL&STAFF	1,239.6	32,560.0	1,684.5	35,606.3	5.2	1.5
MANAGERS, OFFICIALS&PROPRIETORS	346.0	8,521.1	473.2	9,232.9	5.4	1.3
SALES WORKERS	216.9	6,870.8	288.5	7,508.2	4.9	1.5
CLERICAL WORKERS	676.8	17,177.1	922.7	18,865.1	5.3	1.6
COMPUTER&PERIPHERAL EQUIP. OPER.	10.3	223.8	17.2	299.3	8.8	5.0
COMPUTER OPERATORS	8.0	173.2	13.6	236.8	9.4	5.3
PERIPHERAL EDP EQUIP. OPERATORS	2.4	50.5	3.5	62.6	6.9	3.6
SECRETARIES&OFFICE MACH. OPS NEC	156.0	3,858.7	218.6	4,312.3	5.8	1.9
CLERICAL WORKERS NEC	510.5	13,094.6	686.9	14,253.6	5.1	1.4
CRAFT&RELATED WORKERS	517.3	11,108.5	749.1	11,892.5	6.4	1.1
CONSTRUCTION CRAFTS WORKERS	106.0	2,965.2	160.7	3,075.0	7.2	1.2
ELECTRICIANS	22.8	510.5	33.8	539.5	6.8	0.9
FITTERS, PIPELAYING	0.3	8.8	0.4	9.3	7.6	0.9
PLUMBERS&PIPEFITTERS	15.8	373.0	23.6	402.0	6.9	1.3
REFRACTORY MATERIALS REPAIRERS	0.4	7.8	0.7	7.8	7.5	0.2
SHIPWRIGHTS	0.4	3.2	0.5	3.2	3.1	0.0
STRUCTURAL STEEL WORKERS	2.6	71.4	3.9	74.9	7.3	0.8
CONSTRUCTION CRAFTS WORKERS, NEC	63.7	1,890.5	97.7	2,038.3	7.4	1.5
MECHANICS, REPAIRERS&INSTALLERS	149.5	3,603.9	208.9	3,955.3	5.7	1.6
AIRCRAFT MECHANICS	10.6	77.4	16.8	88.7	7.6	2.3
AUTO MECHANICS&REPAIRERS	32.6	970.3	44.4	1,083.3	5.3	1.9
DATA PROCESSING MACHINE MECHANICS	3.6	88.5	6.7	131.0	11.0	6.8
DIESEL MECHANICS	6.6	163.2	9.0	179.0	5.2	1.5
ELEC. INSTRUMENT&TOOL REPAIRERS	0.8	7.8	1.4	8.4	8.5	2.3
ELECTRIC MOTOR REPAIRERS	1.0	20.6	1.6	26.0	8.3	3.9
ENGINEERING EQUIPMENT REPAIRERS	2.5	68.2	3.4	72.7	5.4	1.1
INSTRUMENT REPAIRERS	2.6	30.1	3.8	38.9	6.5	0.4
MAINT. MECH&REPAIRERS GEN UTIL	37.9	891.1	53.1	953.3	5.8	1.1
MARINE MECHANICS&REPAIRERS	0.5	8.7	0.6	8.9	3.1	0.3
MILLWRIGHTS	4.9	90.4	7.3	94.9	7.0	0.7
TELEPHONE INSTALLERS&REPAIRERS	10.3	253.3	13.3	277.6	8.4	1.5
MECHANICS REPAIRERS INSTALL. NEC	35.7	930.1	48.1	996.6	5.1	1.2
METALWORKING CRAFTS WORKERS	60.6	884.0	91.1	915.7	7.0	0.6
BLACKSMITHS	0.3	5.4	0.4	5.3	5.7	-0.4
BOILERMAKERS	1.8	39.7	2.5	40.2	5.8	0.2
CUREMAKERS, HAND, BENCH, FLOOR	0.6	9.2	0.8	9.0	6.6	-0.5
FORGING PRESS OPERATORS	0.9	8.9	1.4	9.3	7.3	0.7
HEADER OPERATORS	0.3	5.5	0.5	5.6	6.8	0.1
HEAT TREATERS,ANNEALERS,TEMPERERS	2.1	24.9	3.2	25.8	7.5	0.6
LAYOUT MARKERS, METAL	1.7	20.9	2.6	21.2	7.3	0.2
MACH. TOOL SETTERS, METALWORKING	5.1	55.3	8.0	58.8	7.6	1.0
MACHINISTS	18.1	257.7	26.6	272.0	6.7	0.9

REGIONAL OCCUPATION PLANNING AND EVALUATION SYSTEM
FORECAST OF NATIONAL EMPLOYMENT BY OCCUPATION
(THOUSANDS OF PERSONS EXCEPT AS NOTED)

OCCUPATION	1981		1987		AVG. ANN. % GROWTH	
	DEFENSE	TOTAL	DEFENSE	TOTAL	DEFENSE	TOTAL
MOLDERS, METAL	2.3	39.1	3.4	38.1	6.7	-0.4
MOLDERS, BENCH&FLOOR	0.8	12.7	1.2	12.5	6.8	-0.3
MOLDERS, MACHINE	1.2	19.0	1.7	18.7	7.0	-0.3
MOLDERS, METAL NEC	0.4	7.4	0.5	7.0	5.6	-0.9
PATTERNMAKERS, METAL	0.8	7.7	1.2	7.9	7.5	0.5
PUNCH PRESS SETTERS, METAL	1.2	19.2	1.9	20.2	7.3	0.8
ROLLING MILL OPERATORS&HELPERS	0.7	10.8	1.0	10.8	7.4	0.0
SHEAR&SLITTER SETTERS	0.3	5.4	0.5	5.4	7.5	0.5
SHEET-METAL WORKERS&TINSMITHS	11.5	200.8	17.6	210.7	7.3	0.8
TOOL&DIE MAKERS	12.1	161.4	18.3	163.2	7.1	0.2
METALWORKING CRAFT WORKERS NEC	0.8	11.9	1.2	12.2	6.4	0.4
PRINTING TRADES CRAFT WORKERS	13.8	309.4	17.6	307.1	6.4	-0.1
OTHER CRAFT&RELATED WORKERS	187.4	3,355.9	270.6	3,549.3	6.3	0.9
AUXILIARY EQUIPMENT OPERATORS	0.3	8.2	0.4	7.6	2.8	-1.3
BLUE COLLAR WORKER SUPERVISORS	67.5	1,207.7	96.9	1,279.5	6.2	1.0
HEAVY EQUIPMENT OPERATORS	11.1	342.8	14.8	350.2	7.1	0.7
INSPECTORS	41.7	849.5	62.5	901.7	7.0	1.1
LENS GRINDERS	0.5	11.0	0.9	12.9	8.5	2.6
MACHINE SETTERS, PLASTIC MATL	0.3	7.5	0.4	8.0	6.5	1.1
PATTERNMAKERS, WOOD	0.5	7.1	0.8	7.1	7.1	0.0
PATTERNMAKERS, NEC	0.1	1.5	0.1	1.6	7.9	1.2
SHIPFITTERS	2.4	13.8	2.9	14.3	3.2	0.5
SHIP ENGINEERS	0.5	8.6	0.6	8.4	3.0	-0.3
TESTERS	10.6	105.1	16.8	114.0	7.9	1.4
CRAFT&RELATED WORKERS, NEC	51.9	1,173.1	71.7	1,236.0	5.5	0.9
OPERATIVES	728.8	13,867.6	1,044.7	14,504.7	6.2	0.9
ASSEMBLERS	163.6	1,660.9	259.4	1,823.3	8.0	1.6
AIRCRAFT STRUCTURE&SURFACE ASSEMB	10.3	25.0	15.9	29.6	7.5	2.9
ELECTRICAL&ELECTRONIC ASSEMBLERS	33.4	231.1	54.3	262.5	8.5	2.1
ELECRO-MECHANICAL EQUIP. ASSEMB.	7.3	57.8	11.7	64.2	8.1	1.8
INSTRUMENT MAKERS&ASSEMBLERS	2.7	20.8	4.4	23.9	8.3	2.6
MACHINE ASSEMBLERS	5.6	100.7	8.7	102.8	7.4	0.3
ASSEMBLERS, NEC	104.3	1,221.5	164.5	1,335.2	7.9	1.5
METALWORKING OPERATIVES	120.5	1,620.7	184.2	1,694.0	7.3	0.7
DRILL PRESS&BORING MACH. OPER.	9.9	123.0	15.3	128.9	7.6	0.8
ELECTROPLATORS	2.2	30.3	3.8	39.9	8.7	1.6
GRINDING&HONING MACH. OPER.	10.5	130.1	16.3	136.1	7.6	0.7
HEATERS, METAL	0.5	6.5	0.8	6.7	7.2	0.4
LATHE MACHINE OPERATORS, METAL	13.6	155.1	21.0	162.4	7.6	0.8
MACHINE TOOL OPERATORS, COMB.	14.1	166.9	21.7	175.1	7.5	0.8
MACHINE TOOL OPER. NUMER. CONTROL	5.5	51.8	8.7	55.3	7.0	1.1
MACHINE TOOL OPERATORS, TOOL ROOM	3.4	38.1	5.3	40.2	7.6	0.9
MILLING&PLANING MACHINE OPERATORS	8.9	71.2	13.8	75.6	7.5	1.0
POURERS, METAL	0.0	15.5	1.5	16.3	8.1	0.9
POWER BRAKE&BENDING MACH. OP.	2.6	39.7	4.0	41.3	7.6	0.7
PUNCH PRESS OPERATORS, METAL	10.1	182.5	15.8	187.0	7.2	0.4
WELDERS&FLAMECUTTERS	33.4	353.3	48.9	370.7	6.6	0.7

REGIONAL OCCUPATION PLANNING AND EVALUATION SYSTEM
FORECAST OF NATIONAL EMPLOYMENT BY OCCUPATION
(THOUSANDS OF PERSONS EXCEPT AS NOTED)

OCCUPATION	1981		1987		AVG. ANN. % GROWTH	
	DEFENSE	TOTAL	DEFENSE	TOTAL	DEFENSE	TOTAL
METALWORKING OPERATIVES NEC	3.6	50.6	5.8	52.7	8.1	0.7
ALL OTHER OPERATIVES	498.7	10,586.1	601.2	11,077.4	3.2	0.8
BATCH PLANT OPERATIVES	0.2	7.9	0.4	8.3	8.4	0.7
BLASTERS	0.4	9.3	0.6	9.8	6.5	0.9
BOPING MACHINE OPERATORS, WOOD	0.1	4.9	0.2	5.3	8.5	1.4
COIL FINISHERS	0.8	7.3	1.5	8.5	10.0	2.5
CUTTERS, MACHINE	0.9	28.8	1.2	29.5	3.7	0.4
CUTTERS, PORTABLE MACHINE	0.5	16.6	0.6	17.4	2.0	0.8
CUTTER-FINISH OPER., RUBBER GOODS	0.3	7.8	0.4	7.9	6.7	1.1
DIE CUTTERS&CLICKING MACH. OPER.	0.6	20.1	0.7	19.7	2.6	-0.4
DRILLERS, HAND&MACHINE	0.8	18.3	1.2	19.5	7.5	1.1
FILERS, GRINDERS, BUFFERS&CHIPPERS	11.0	128.7	17.0	133.9	7.5	1.2
FURNACE OPER.&TENDERS, EX. METAL	2.0	49.2	2.6	49.0	8.6	-0.1
WINDING OPERATORS, NEC	8.5	49.3	7.5	54.0	8.8	1.5
WIPERS, ELECTRONIC	6.0	30.8	9.9	36.7	8.6	3.0
OPERATIVES, NEC	816.8	10,211.4	557.5	10,477.9	5.0	0.7
SERVICE WORKERS	884.2	12,901.0	644.0	14,285.6	4.9	1.7
FOOD SERVICE WORKERS	232.1	6,125.8	302.7	6,586.8	4.5	1.1
SELECTED HEALTH SERVICE WORKERS	81.9	1,411.3	57.8	1,805.8	5.5	4.2
PROTECTIVE SERVICE WORKERS	32.7	680.4	46.2	784.1	5.9	1.5
SERVICE WORKERS, NEC	177.6	8,683.6	237.2	5,147.0	8.9	1.6
LABORS, EXCEPT FARM	197.8	5,018.2	272.3	5,312.1	5.5	1.0
FARMERS&FARM WORKERS	0.0	0.0	0.0	0.0	--	--

REGIONAL OCCUPATION PLANNING AND EVALUATION SYSTEM
FORECAST OF EMPLOYMENT BY OCCUPATION IN CALIFORNIA
(THOUSANDS OF PERSONS EXCEPT AS NOTED)

OCCUPATION	1981		1987		AVG. ANN. % GROWTH	
	DEFENSE	TOTAL	DEFENSE	TOTAL	DEFENSE	TOTAL
TOTAL, ALL OCCUPATIONS	564.5	9,873.4	847.1	11,429.9	7.0	2.5
ENGINEERS	30.3	146.1	53.6	192.6	10.1	4.7
AERO-ASTRONAUTIC ENGINEERS	7.9	16.5	15.4	25.9	11.7	7.8
CHEMICAL ENGINEERS	0.4	5.0	0.7	6.0	8.0	2.8
CIVIL ENGINEERS	0.5	10.4	0.8	12.8	6.9	3.5
ELECTRICAL ENGINEERS	8.9	49.0	16.2	66.9	10.5	5.3
INDUSTRIAL ENGINEERS	2.0	13.6	3.5	16.8	9.8	3.6
MECHANICAL ENGINEERS	3.7	23.7	6.5	30.2	9.7	4.1
METALLURGICAL ENGINEERS	0.2	1.5	0.4	2.0	10.6	4.6
PETROLEUM ENGINEERS	0.1	1.4	0.1	1.6	7.8	3.2
ALL OTHER ENGINEERS	6.4	24.8	10.1	30.1	8.0	3.3
SCIENTISTS NEC	1.7	21.8	2.6	25.8	7.4	2.9
CHEMISTS	0.5	7.3	0.8	8.5	7.1	2.6
PHYSICISTS	0.2	1.8	0.4	2.1	8.4	3.0
BIOLOGICAL&MEDICAL SCIENTISTS	0.2	3.4	0.2	4.1	5.6	2.9
LIFE&PHYSICAL SCINTISTS NEC	0.3	4.8	0.5	5.7	7.0	2.7
MATHEMATICIANS&STATISTICIANS	0.4	3.3	0.7	4.0	7.8	3.1
MATHEMATICAL SPECIALISTS NEC	0.1	1.1	0.1	1.5	7.7	4.6
ENGINEERING&SCIENCE TECHNICIANS	14.8	128.6	25.1	161.2	9.2	3.8
CIVIL ENGINEERING TECHNICIANS	0.1	2.6	0.1	3.3	4.7	3.7
DRAFTERS	2.9	33.5	4.8	41.5	8.8	3.6
ELECTRICAL&ELECTRONIC TECHNICIANS	6.3	49.6	11.1	64.2	9.8	4.4
INDUSTRIAL ENGINEERING TECHNICIANS	0.4	2.9	0.7	3.5	8.8	3.5
MECHANICAL ENGINEERING TECHNICIANS	1.7	7.0	3.0	9.1	9.5	4.3
ENGINEERING&SCIENCE TECH NEC	3.4	32.9	5.5	39.6	8.3	3.1
HEALTH WORKERS	12.0	331.8	16.5	420.1	5.4	4.0
DENTISTS	0.6	17.8	0.9	23.5	5.7	4.7
PROFESSIONAL NURSES	3.9	107.6	5.7	145.6	6.3	5.2
PHYSICIANS, MEDICAL&OSTEOPATHIC	1.7	46.5	2.3	60.3	5.5	4.4
ALL OTHER HEALTH PROFESSIONALS	0.7	23.0	1.0	27.1	5.2	2.8
OTHER HEALTH WORKERS	5.1	136.9	6.6	163.7	4.5	3.0
TECHNICIANS NEC	2.2	22.9	3.3	26.4	7.2	2.4
AIRPLANE PILOTS&FLIGHT ENGINEERS	0.9	9.3	1.3	10.9	7.0	2.7
TECHNICAL ASSISTANTS, LIBRARY	0.1	3.3	0.1	3.6	2.5	1.5
TOOL PROGRAMMERS-NUMERICAL CONTROL	0.3	1.4	0.5	1.6	8.3	3.2
ALL OTHER TECHNICIANS NEC	0.9	8.6	1.8	10.2	7.5	2.8
COMPUTER SPECIALISTS	4.1	51.3	7.9	72.1	11.5	5.9
COMPUTER PROGRAMMERS	2.9	28.8	3.6	38.6	10.0	5.0
COMPUTER SYSTEMS ANALYSTS	2.1	22.5	4.3	33.6	12.9	6.9
SOCIAL SCIENT.,OTHER PROFESSIONALS	87.1	922.7	63.4	989.4	5.1	1.2
ECONOMISTS	0.1	1.7	0.2	2.2	9.6	4.1
SOCIAL SCIENTISTS NEC	0.6	12.9	0.9	15.6	6.2	3.3
TEACHERS	14.2	305.5	18.0	362.8	-0.2	-1.6
COLLEGE&UNIVERSITY TEACHERS	1.4	40.9	1.7	44.8	0.9	0.0
ELEM&SECOND SCHOOL TEACHERS	8.9	251.7	7.6	204.2	-2.5	-3.6
VOCATIONAL EDUCATION TEACHERS	0.1	2.9	0.2	3.4	8.8	3.4
ALL OTHER TEACHERS	3.5	98.0	8.8	108.2	3.9	2.4

REGIONAL OCCUPATION PLANNING AND EVALUATION SYSTEM
FORECAST OF EMPLOYMENT BY OCCUPATION IN CALIFORNIA
(THOUSANDS OF PERSONS EXCEPT AS NOTED)

OCCUPATION	1981		1987		AVG. ANN. % GROWTH	
	DEFENSE	TOTAL	DEFENSE	TOTAL	DEFENSE	TOTAL
WRITERS, ARTISTS & ENTERTAINERS	7.1	116.7	10.6	133.5	6.8	2.3
PROFESSIONAL&TECH WORKERS NEC	25.1	395.9	37.7	475.4	7.0	3.1
BUSINESS PROFESSIONALS&STAFF	172.7	3,642.6	252.5	4,256.1	6.5	2.6
MANAGERS, OFFICIALS&PROPRIETORS	50.5	960.8	74.1	1,112.6	6.6	2.5
SALES WORKERS	26.3	752.1	37.5	875.8	6.1	2.6
CLERICAL WORKERS	95.9	1,929.7	141.0	2,264.1	6.6	2.7
COMPUTER&PERIPHERAL EQUIP. OPER.	1.6	26.3	2.9	38.0	9.8	6.3
COMPUTER OPERATORS	1.3	20.6	2.3	30.3	10.3	6.8
PERIPHERAL EDP EQUIP. OPERATORS	0.4	5.7	0.6	7.6	8.0	4.7
SECRETARIES&OFFICE MACH. OPS NEC	23.4	432.9	35.5	519.8	7.2	3.1
CLERICAL WORKERS NEC	70.9	1,470.5	102.6	1,710.3	6.3	2.6
CRAFT&RELATED WORKERS	76.8	1,181.3	118.3	1,354.7	7.5	2.3
CONSTRUCTION CRAFTS WORKERS	15.8	316.4	25.1	362.5	8.0	2.3
ELECTRICIANS	3.3	53.6	5.2	60.8	7.8	2.1
PLUMBERS&PIPEFITTERS	2.8	41.0	3.7	47.2	7.8	2.4
SHIPWRIGHTS	0.1	0.6	0.1	0.6	4.5	0.7
STRUCTURAL STEEL WORKERS	0.8	7.9	0.4	8.8	8.0	1.9
CONSTRUCTION CRAFTS WORKERS, NEC	9.7	212.0	15.8	283.6	8.1	2.3
MECHANICS, REPAIRERS&INSTALLERS	20.3	393.6	30.4	441.7	6.9	2.7
AIRCRAFT MECHANICS	1.9	10.9	3.1	13.4	8.5	3.5
AUTO MECHANICS&REPAIRERS	4.1	109.9	5.9	129.9	6.3	2.8
DATA PROCESSING MACHINE MECHANICS	0.6	12.3	1.1	19.0	11.8	7.5
DIESEL MECHANICS	0.8	18.5	1.2	21.5	8.2	2.6
ELEC. INSTRUMENT&TOOL REPAIRERS	0.2	1.2	0.3	1.5	9.5	3.9
ELECTRIC MOTOR REPAIRERS	0.1	2.3	0.2	3.1	9.4	8.9
ENGINEERING EQUIPMENT REPAIRERS	0.3	6.9	0.5	7.9	8.7	2.1
INSTRUMENT REPAIRERS	0.4	3.1	0.6	3.5	7.9	2.0
MAINT. MECH&REPAIRERS GEN UTIL	5.1	92.5	7.7	105.6	7.0	2.2
MARINE MECHANICS&REPAIRERS	0.1	1.1	0.1	1.2	4.2	1.2
MILLWRIGHTS	0.7	7.4	1.0	8.3	7.8	2.0
TELEPHONE INSTALLERS&REPAIRERS	1.5	32.7	2.0	38.1	4.9	2.6
MECHANICS REPAIRERS INSTALL. NEC	4.5	98.8	6.6	108.8	6.4	2.3
METALWORKING CRAFTS WORKERS	9.7	88.5	15.4	100.5	8.0	2.1
BOILERMAKERS	0.2	4.3	0.3	4.6	4.3	1.2
FORGING PRESS OPERATORS	0.1	0.9	0.2	1.0	8.1	2.2
HEAT TREATERS, ANNEALERS, TEMPERERS	0.3	2.2	0.5	2.5	8.4	2.4
LAYOUT MARKERS, METAL	0.3	2.2	0.5	2.5	8.3	1.8
MACH. TOOL SETTERS, METALWORKING	0.9	5.9	1.5	6.9	8.3	2.7
MACHINISTS	3.9	26.9	4.5	30.9	7.6	2.3
MOLDERS, METAL	0.2	2.4	0.3	2.6	8.2	1.2
MOLDERS, BENCH&FLOOR	0.1	0.8	0.1	0.8	7.9	1.3
MOLDERS, MACHINE	0.1	1.2	0.2	1.3	8.8	1.6
PATTERNMAKERS, METAL	0.1	0.7	0.2	0.9	8.4	2.7
PUNCH PRESS SETTERS, METAL	0.2	1.9	0.3	2.2	8.4	2.4
SHEET-METAL WORKERS&TINSMITHS	2.0	22.8	3.3	25.9	8.3	2.1
TOOLDIE MAKERS	2.1	15.6	3.3	17.0	8.1	2.1
METALWORKING CRAFT WORKERS NEC	0.1	0.8	0.1	0.9	8.0	1.9

REGIONAL OCCUPATION PLANNING AND EVALUATION SYSTEM
FORECAST OF EMPLOYMENT BY OCCUPATION IN CALIFORNIA
(THOUSANDS OF PERSONS EXCEPT AS NOTED)

OCCUPATION	1981		1987		AVG. ANN. % GROWTH	
	DEFENSE	TOTAL	DEFENSE	TOTAL	DEFENSE	TOTAL
PRINTING TRADES CRAFT WORKERS	1.6	38.1	2.2	39.4	5.7	0.5
OTHER CRAFT&RELATED WORKERS	29.3	344.7	45.2	390.7	7.5	2.1
BLUE COLLAR WORKER SUPERVISORS	10.3	120.5	15.8	137.2	7.4	2.2
HEAVY EQUIPMENT OPERATORS	1.2	32.5	1.9	35.4	7.6	1.5
INSPECTORS	8.2	53.2	13.9	61.9	7.9	2.5
LENS GRINDERS	0.1	1.1	0.1	1.4	9.1	3.7
PATTERNMAKERS, WOOD	0.1	0.5	0.1	0.6	8.4	2.3
SHIPFITTERS	0.3	3.0	0.4	3.2	8.7	1.0
SHIP ENGINEERS	0.1	1.0	0.1	1.1	3.9	0.8
TESTERS	2.2	12.8	3.7	15.6	9.0	3.3
CRAFT&RELATED WORKERS, NEC	6.8	118.4	10.0	132.7	6.7	1.9
OPERATIVES	111.4	1,378.5	173.6	1,555.1	7.7	2.0
ASSEMBLERS	36.6	219.0	61.2	266.6	8.9	3.3
AIRCRAFT STRUCTURES&SURFACE ASSEMB	2.3	5.8	3.6	7.2	8.1	3.6
ELECTRICAL&ELECTRONIC ASSEMBLERS	7.9	43.5	13.5	54.0	9.2	3.6
ELECTRO-MECHANICAL EQUIP. ASSEMB.	1.6	9.1	2.7	11.2	9.1	3.6
INSTRUMENT MAKERS&ASSEMBLERS	0.6	3.8	1.0	5.0	9.4	4.4
MACHINE ASSEMBLERS	0.9	9.0	1.5	10.4	8.7	2.4
ASSEMBLERS, NEC	23.3	147.7	38.8	178.9	8.9	3.2
METALWORKING OPERATIVES	20.1	163.4	32.6	188.6	8.4	2.4
DRILL PRESS&BORING MACH. OPER.	1.8	12.4	2.9	14.6	8.6	2.7
ELECTROPLATORS	0.7	5.2	1.2	6.4	9.9	3.4
GRINDING&ABRADING MACH. OPER.	1.7	12.5	2.9	14.6	8.5	2.5
HEATERS, METAL	0.1	0.5	0.1	0.6	8.0	1.8
LATHE MACHINE OPERATORS, METAL	2.3	15.9	3.8	18.6	8.5	2.7
MACHINE TOOL OPERATORS, COMB.	2.8	17.5	3.9	20.4	8.5	2.6
MACHINE TOOL OPER. NUMER. CONTROL	1.2	6.3	1.9	7.6	8.7	3.2
MACHINE TOOL OPERATORS, TOOL ROOM	0.6	3.9	1.0	4.4	8.3	2.8
MILLING&PLANING MACHINE OPERATORS	1.9	8.4	3.1	10.1	8.3	3.1
POURERS, METAL	0.1	0.8	0.1	0.9	8.5	1.8
PUNCH BRAKE&BENDING MACH. OP.	0.4	4.0	0.7	4.5	8.5	2.1
PUNCH PRESS OPERATORS, METAL	1.8	10.7	2.3	10.7	8.4	1.9
WELDERS&FLAMECUTTERS	5.1	55.3	8.0	62.8	7.9	2.0
METALWORKING OPERATIVES NEC	0.8	4.1	0.7	4.8	9.6	2.5
ALL OTHER OPERATIVES	58.7	990.1	79.8	1,099.9	6.5	1.7
COIL FINISHERS	0.2	1.3	0.4	1.7	11.2	4.7
CUTTERS, MACHINE	0.1	2.0	0.1	2.1	3.9	0.3
FILERS, GRINDERS, BUFFERS&CHIPPERS	1.8	12.9	2.9	15.0	8.3	2.6
FURNACE OPER.&TENDERS, EX. METAL	0.3	4.6	0.4	4.8	5.6	0.8
PIPING OPERATORS, NEC	0.9	6.3	1.7	7.9	10.2	3.9
WIREMEN, ELECTRONIC	1.8	5.3	2.4	7.1	9.2	4.8
OPERATIVES, NEC	49.9	958.0	71.8	1,055.8	6.3	1.6
SERVICE WORKERS	65.6	1,523.9	92.6	1,784.9	5.9	2.7
FOOD SERVICE WORKERS	30.2	784.4	41.8	845.3	5.5	2.1
SELECTED HEALTH SERVICE WORKERS	5.2	144.3	7.6	200.7	6.5	5.8
PROTECTIVE SERVICE WORKERS	5.4	89.3	8.0	104.0	6.9	2.6
SERVICE WORKERS, NEC	24.8	503.9	35.3	636.9	6.1	2.7

REGIONAL OCCUPATION PLANNING AND EVALUATION SYSTEM
FORECAST OF EMPLOYMENT BY OCCUPATION IN CALIFORNIA
(THOUSANDS OF PERSONS EXCEPT AS NOTED)

OCCUPATION	1981		1987		AVG. ANN. % GROWTH	
	DEFENSE	TOTAL	DEFENSE	TOTAL	DEFENSE	TOTAL
LABORS, EXCEPT FARM	25.7	522.1	37.4	589.2	6.3	2.0

REGIONAL OCCUPATION PLANNING AND EVALUATION SYSTEM
FORECAST OF EMPLOYMENT BY OCCUPATION IN LOS ANGELES
(THOUSANDS OF PERSONS EXCEPT AS NOTED)

OCCUPATION	1981		1987		AVG. ANN. % GROWTH	
	DEFENSE	TOTAL	DEFENSE	TOTAL	DEFENSE	TOTAL
TOTAL, ALL OCCUPATIONS	239.9	3,136.9	361.6	3,664.9	7.1	2.6
ENGINEERS	15.8	51.7	28.0	71.4	10.1	5.5
AERO-ASTRONAUTIC ENGINEERS	5.0	8.9	9.7	14.7	11.8	8.7
CHEMICAL ENGINEERS	0.2	1.1	0.3	1.3	7.8	3.6
CIVIL ENGINEERS	0.2	3.1	0.3	3.8	6.6	3.4
ELECTRICAL ENGINEERS	3.6	15.2	6.5	21.2	10.2	5.7
INDUSTRIAL ENGINEERS	1.1	4.5	1.8	5.8	9.3	4.4
MECHANICAL ENGINEERS	2.0	8.3	3.5	11.1	9.7	5.1
METALLURGICAL ENGINEERS	0.1	0.6	0.3	0.8	11.1	5.9
ALL OTHER ENGINEERS	3.5	9.9	5.6	12.5	8.0	3.9
SCIENTISTS NEC	0.8	5.9	1.2	7.1	7.4	3.2
CHEMISTS	0.2	1.3	0.4	1.6	7.1	3.0
PHYSICISTS	0.1	0.6	0.2	0.8	8.7	3.5
BIOLOGICAL&MEDICAL SCIENTISTS	0.1	1.1	0.1	1.3	5.4	2.9
LIFE&PHYSICAL SCINTISTS NEC	0.1	1.1	0.2	1.4	6.9	3.1
MATHEMATICIANS&STATISTICIANS	0.2	1.3	0.4	1.6	7.9	3.3
ENGINEERING&SCIENCE TECHNICIANS	0.8	41.6	11.3	52.8	8.9	4.1
DRAFTERS	1.3	10.7	2.1	13.3	8.6	3.7
ELECTRICAL&ELECTRONIC TECHNICIANS	2.5	15.2	4.4	20.0	9.5	4.6
INDUSTRIAL ENGINEERING TECHNICIANS	0.2	1.0	0.4	1.3	8.7	4.0
MECHANICAL ENGINEERING TECHNICIANS	1.0	3.1	1.7	4.1	9.3	4.7
ENGINEERING&SCIENCE TECH NEC	1.7	10.4	2.7	12.7	8.1	3.5
HEALTH WORKERS	4.9	134.7	6.6	166.0	4.9	3.5
DENTISTS	0.3	7.3	0.4	9.4	5.2	4.2
PROFESSIONAL NURSES	1.6	44.1	2.3	58.0	5.9	4.7
PHYSICIANS, MEDICAL&OSTEOPATHIC	0.7	19.1	0.9	24.1	5.1	3.9
ALL OTHER HEALTH PROFESSIONALS	0.3	8.4	0.4	9.9	5.0	2.7
OTHER HEALTH WORKERS	2.1	55.7	2.6	64.6	4.0	2.5
TECHNICIANS NEC	1.1	8.6	1.6	10.1	7.3	2.7
AIRPLANE PILOTS&FLIGHT ENGINEERS	0.4	3.5	0.6	4.2	7.2	2.8
TOOL PROGRAMMERS&NUMERICAL CONTROL	0.2	0.6	0.3	0.7	8.2	3.-
ALL OTHER TECHNICIANS NEC	0.4	3.1	0.7	3.7	7.4	3.1
COMPUTER SPECIALISTS	1.8	16.3	3.5	23.5	11.7	6.3
COMPUTER PROGRAMMERS	0.8	8.9	1.5	12.2	9.9	5.8
COMPUTER SYSTEMS ANALYSTS	1.0	7.3	2.0	11.3	13.1	7.4
SOCIAL SCIENT.&OTHER PROFESSIONALS	21.3	357.0	28.8	375.2	5.2	0.8
ECONOMISTS	0.1	0.6	0.1	0.8	10.4	4.6
SOCIAL SCIENTISTS NEC	0.2	4.9	0.3	5.4	5.9	3.0
TEACHERS	5.9	163.2	5.6	145.3	-0.7	-1.9
COLLEGE&UNIVERSITY TEACHERS	0.7	19.3	0.7	18.7	-2.4	-0.5
ELEM&SECOND SCHOOL TEACHERS	3.6	103.7	3.0	81.6	-3.0	-3.9
ALL OTHER TEACHERS	1.5	38.9	1.8	43.5	3.5	1.9
WRITERS, ARTISTS & ENTERTAINERS	3.4	44.1	5.0	51.1	6.8	2.5
PROFESSIONAL&TECH WORKERS NEC	11.7	144.2	17.7	172.1	7.1	3.0
BUSINESS PROFESSIONALS&STAFF	70.3	1,234.1	103.0	1,445.9	6.6	2.7
MANAGERS, OFFICIALS&PROPRIETORS	21.2	311.9	31.1	362.4	6.6	2.5
SALES WORKERS	9.4	257.1	14.0	300.5	8.1	2.6

REGIONAL OCCUPATION PLANNING AND EVALUATION SYSTEM
FORECAST OF EMPLOYMENT BY OCCUPATION IN LOS ANGELES
(THOUSANDS OF PERSONS EXCEPT AS NOTED)

OCCUPATION	1981		1987		AVG. ANN. % GROWTH	
	DEFENSE	TOTAL	DEFENSE	TOTAL	DEFENSE	TOTAL
CLERICAL WORKERS	39.4	665.1	58.0	782.7	6.7	2.7
COMPUTER&PERIPHERAL EQUIP. OPER.	0.7	8.7	1.2	12.8	9.3	6.6
COMPUTER OPERATORS	0.5	6.7	0.9	10.1	9.8	7.1
PERIPHERAL EDP EQUIP. OPERATORS	0.2	2.0	0.3	2.7	7.9	5.0
SECRETARIES&OFFICE MACH. OPS NEC	9.9	150.9	15.1	180.2	7.2	3.0
CLERICAL WORKERS NEC	28.7	505.5	41.7	589.7	6.4	2.6
CRAFT&RELATED WORKERS	33.4	200.8	51.7	309.8	7.5	2.9
CONSTRUCTION CRAFTS WORKERS	5.8	26.2	9.2	32.0	8.0	3.4
ELECTRICIANS	1.3	6.1	2.1	7.3	7.9	3.1
PLUMBERS&PIPEFITTERS	0.9	3.5	1.4	4.3	8.0	3.4
STRUCTURAL STEEL WORKERS	0.1	0.4	0.2	0.5	8.1	4.0
CONSTRUCTION CRAFTS WORKERS, NEC	3.4	16.1	5.5	19.8	8.0	3.5
MECHANICS, REPAIRERS&INSTALLERS	4.5	121.0	12.9	140.3	7.1	3.0
AIRCRAFT MECHANICS	1.3	5.7	2.1	7.1	8.0	3.8
AUTO MECHANICS&REPAIRERS	1.6	37.7	2.3	44.0	6.9	2.9
DATA PROCESSING MACHINE MECHANICS	0.2	3.6	0.4	5.7	11.1	7.8
DIESEL MECHANICS	0.3	6.3	0.4	7.4	6.2	2.7
ELEC. INSTRUMENT&TOOL REPAIRERS	0.1	0.4	0.1	0.5	9.1	3.8
ENGINEERING EQUIPMENT REPAIRERS	0.1	1.8	0.2	2.1	6.9	2.5
INSTRUMENT REPAIRERS	0.2	0.8	0.4	1.0	8.0	3.2
MAINT. MECH&REPAIRERS GEN UTIL	2.2	25.6	3.3	30.1	7.0	2.7
MILLWRIGHTS	0.3	1.3	0.5	1.6	7.8	3.3
TELEPHONE INSTALLERS&REPAIRERS	0.4	10.0	0.6	11.6	4.9	2.6
MECHANICS REPAIRERS INSTALL. NEC	1.7	26.6	2.5	30.8	6.5	2.5
METALWORKING CRAFTS WORKERS	5.0	26.7	8.0	31.6	8.1	2.9
BOILERMAKERS	0.1	0.5	0.1	0.5	6.7	3.1
FORGING PRESS OPERATORS	0.1	0.4	0.2	0.5	8.2	2.6
HEAT TREATERS, ANNEALERS, TEMPERERS	0.2	0.8	0.3	1.0	8.3	3.1
LAYOUT MARKERS, METAL	0.2	0.6	0.3	0.8	8.4	3.4
MACH. TOOL SETTERS, METALWORKING	0.5	2.8	0.9	3.3	8.2	2.9
MACHINISTS	1.4	8.8	2.2	10.5	7.8	2.9
MOLDERS, METAL	0.1	0.5	0.2	0.6	8.1	3.3
PATTERNMAKERS, METAL	0.1	0.4	0.1	0.4	8.3	3.1
PUNCH PRESS SETTERS, METAL	0.1	0.7	0.2	0.8	8.3	2.9
SHEET-METAL WORKERS&TINSMITHS	1.0	3.9	1.7	4.8	8.3	3.3
TOOL&DIE MAKERS	1.1	6.3	1.8	7.3	8.0	2.5
METALWORKING CRAFT WORKERS NEC	0.1	0.2	0.1	0.3	7.9	3.0
PRINTING TRADES CRAFT WORKERS	0.7	2.5	0.9	2.9	5.3	2.4
OTHER CRAFT&RELATED WORKERS	13.4	80.0	20.7	99.0	7.5	2.8
BLUE COLLAR WORKER SUPERVISORS	4.8	30.5	7.4	38.0	7.3	2.8
HEAVY EQUIPMENT OPERATORS	0.3	0.9	0.5	1.1	7.5	3.5
INSPECTORS	4.2	17.1	6.6	20.6	7.8	3.2
TESTERS	0.9	3.6	1.5	4.6	8.6	4.1
CRAFT&RELATED WORKERS, NEC	2.9	30.5	4.4	35.1	6.8	2.3
OPERATIVES	84.4	358.0	77.2	423.7	7.7	2.8
ASSEMBLERS	10.4	73.1	20.9	90.8	8.6	3.7
AIRCRAFT STRUCTURE&SURFACE ASSEMB	1.7	4.2	2.7	5.3	8.1	3.7

REGIONAL OCCUPATION PLANNING AND EVALUATION SYSTEM
FORECAST OF EMPLOYMENT BY OCCUPATION IN LOS ANGELES
(THOUSANDS OF PERSONS EXCEPT AS NOTED)

OCCUPATION	1981		1987		AVG. ANN. % GROWTH	
	DEFENSE	TOTAL	DEFENSE	TOTAL	DEFENSE	TOTAL
ELECTRICAL&ELECTRONIC ASSEMBLERS	3.0	13.2	5.0	16.6	8.9	3.9
ELECTRO-MECHANICAL EQUIP. ASSEMB.	0.7	3.3	1.2	4.1	8.8	3.8
INSTRUMENT MAKERS&ASSEMBLERS	0.2	1.2	0.3	1.6	9.3	4.4
MACHINE ASSEMBLERS	0.5	3.7	0.8	4.4	8.7	2.7
ASSEMBLERS, NEC	10.4	47.4	17.0	58.8	8.6	3.7
METALWORKING OPERATIVES	10.7	60.9	17.3	72.4	8.4	2.9
DRILL PRESS&BORING MACH. OPER.	1.0	5.4	1.6	6.4	8.5	3.0
ELECTROPLATORS	0.3	2.2	0.5	2.6	9.2	2.9
GRINDING&ABRADING MACH. OPER.	1.1	5.8	1.7	6.9	8.4	2.8
LATHE MACHINE OPERATORS, METAL	1.6	7.8	2.3	9.3	8.4	2.9
MACHINE TOOL OPERATORS, COMB.	1.3	8.0	2.1	9.5	8.5	2.8
MACHINE TOOL OPER. NUMER. CONTROL	0.6	2.8	1.1	3.4	8.5	3.4
MACHINE TOOL OPERATORS, TOOL ROOM	0.4	1.8	0.6	2.2	8.2	3.0
MILLING&PLANING MACHINE OPERATORS	1.2	4.3	1.9	5.3	8.2	3.4
POWER BRAKE&BENDING MACH. OP.	0.3	1.3	0.4	1.5	8.6	3.2
PUNCH PRESS OPERATORS, METAL	0.7	5.8	1.1	6.6	8.3	2.3
WELDERS&FLAMECUTTERS	2.2	14.5	3.6	17.2	8.5	3.0
METALWORKING OPERATIVES NEC	0.2	0.9	0.3	1.1	8.9	3.7
ALL OTHER OPERATIVES	22.3	224.1	32.9	260.5	8.7	2.5
COIL FINISHERS	0.1	0.4	0.1	0.5	11.0	4.4
FILERS, GRINDERS, BUFFERS&CHIPPERS	1.1	5.1	1.7	6.1	8.3	3.0
FURNACE OPER.&TENDERS, EX. METAL	0.1	1.0	0.2	1.1	5.7	1.4
WINDING OPERATORS, NEC	0.3	1.8	0.5	2.2	9.7	4.0
WIREMS, ELECTRONIC	0.5	1.8	0.8	2.4	9.0	4.7
OPERATIVES, NEC	20.1	213.9	29.4	248.1	8.5	2.5
SERVICE WORKERS	24.3	544.3	34.0	638.4	5.8	2.6
FOOD SERVICE WORKERS	10.2	252.1	13.9	285.9	5.4	2.1
SELECTED HEALTH SERVICE WORKERS	2.1	80.2	3.0	80.2	6.0	4.9
PROTECTIVE SERVICE WORKERS	2.2	30.7	3.2	36.0	6.9	2.7
SERVICE WORKERS, NEC	9.8	203.3	13.9	236.4	5.9	2.5
LABORS, EXCEPT FARM	10.1	122.3	14.6	141.5	6.4	2.4